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# USSR Report

CHEMISTRY

No. 101

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13 May 1983

## USSR REPORT

## CHEMISTRY

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UDC: 542.61:546.791.6:546.131:547.775

EXTRACTION-PHOTOMETRIC DETERMINATION OF URANIUM (VI) BY ARSENAZO III AFTER  
EXTRACTION FROM CHLORIDE SOLUTIONS BY DIANTIPYRYLALKANES

Moscow ZHURNAL ANALITICHESKOY KHIMII in Russian Vol 38, No 1, Jan 83  
(manuscript received 8 Feb 82) pp 80-83

PETROV, B. I., SHESTAKOVA, G. Ye. and ZHIVOPISTSEV, V. P., Perm State  
University imeni M. Gor'kiy

[Abstract] A number of bis-azosubstituted chromotropic acids have been found to be the best reagents for photometric determination of uranium (VI). Arsenazo III and chlorophosphonazo III are the best of these. However, determinations are hindered by Zr, Th, REM and Ti. The authors studied the extraction of uranium (VI) from chloride solutions by tri-(n-octyl)-amine and mixtures of alkylamines in aromatic hydrocarbons. Separation of uranium (VI) with diantipyrylalkanes to eliminate Ti, Zr, Hf, Th, Sc and REM makes possible sensitive photometric determination of uranium (VI) directly in the extract by means of arsenazo III. The distribution of uranium (VI) between HCl solutions and diantipyrylmethane and diantipyrylheptane solutions in dichloroethane and chloroform is studied. References: 5 Russian.  
[175-6508]



EXTRACTIIONAL CHEMICAL PROCESSING OF TREE FOLIAGE FOR PRODUCTION OF  
BIOLOGICALLY ACTIVE COMPOUNDS (REVIEW)

Riga KHIMIYA DREVESINY in Russian No 1, Jan-Feb 83  
(manuscript received 4 May 82) pp 3-15

YAGODIN, V. I. and ANTONOV, V. I., Leningrad Forestry Technical Academy  
imeni S. M. Kirov

[Abstract] Tree foliage contains a wealth of useful and interesting products, which until recent years remained untapped. Foliage has been successfully used as a food source, in production of medically useful agents, in cosmetics, etc. In the present review an attempt was made to analyze systematically practical experience, patent and scientific literature. The review is subdivided in two subtopics: solvents used in extraction and methods of extraction. The most widely used solvent in extracting foliage is benzine for organic extraction and hot water for aqueous extraction. Laboratory studies identified other, theoretically-better solvents, which could not be used in a practical production set-up for a number of reasons (toxicity, flammability etc). The methods of extraction covered a spectrum of permutations of temperature variations, aqueous vs. organic approach and combinations of both. The advantages of two stage and continuous counter-current extraction methods were mentioned. References 59: 57 Russian, 2 Western.  
[196-7813]

## CATALYSIS

UDC 541.128.13

### ACID AND CATALYTIC PROPERTIES OF FLUORINATED ALUMINUM SILICATE CATALYSTS

Minsk VESTSI AKADEMII NAVUK BSSR: SERYYA KHIMICHNYKH NAVUK in Russian No 1, Jan-Feb 83 (manuscript received 26 Apr 82) pp 7-12

KOMAROV, V. S. and SINILO, M. F., Institute of General and Inorganic Chemistry, BSSR Academy of Sciences

[Abstract] Catalytic and acid properties of fluorinated aluminum silicate were studied with respect to chemical structure, F content, as well as to the mechanism of their formation and the nature of acid centers, using IR spectroscopic data. Catalytic studies showed that aluminum-silicate catalysts activated with fluorine possessed improved cracking capability. In addition, the aluminum-silicate catalysts showed lower coke formation, probably a result of fewer micropores and lower concentration of  $\alpha$ -centers due to the fluorination process. Figures 2; references 20: 15 Russian, 5 Western.  
[194-7813]

UDC 542.953.7:542.973

### SYNTHESIS AND STUDY OF SILICON OXIDE CARRIERS FOR CATALYSTS WITH SURFACE AMINO AND PHOSPHORYL GROUPS

Kiev UKRAINSKIY KHIMICHESKIY ZHURNAL in Russian Vol 49, No 2, Feb 83 (manuscript received 20 Jun 80; after resubmission 16 Jun 82) pp 136-140

GRINENKO, S. B., BELOUSOV, V. M., NOSKOV, A. M., LYSOVA, N. N., BUGERENKO, Ye. F. and CHERNYSHEV, Ye. A., Institute of Physical Chemistry imeni L. V. Pisarzhevskiy, UkSSR Academy of Sciences

[Abstract] Synthesis of silica gels was described with amino and phosphoryl groups attached to their surfaces, capable of forming coordination bonds with various metals. Two types of silica gels were used: (I) with specific surface area of  $180 \text{ m}^2/\text{g}$  and (II) - with  $80 \text{ m}^2/\text{g}$ . The addition reaction with the I silica gel was less complete than with the type II material, which could possibly be explained by traces of water adsorbed on the porous surface of this material, leading to hydrolytic side reactions with the ethoxy groups. As a result of these side reactions, polyfunctional carriers were obtained.

For example, when the starting material was diethyl ester of  $\beta$ -triethoxy-silylethylphosphinic acid, then the products on the surface of the carrier were phosphorus ester groups or hydrolyzed phosphoric acids, structures with a bond system silicon-oxygen-phosphorus and even cyclic structures. Only propylamine led to monofunctional carriers. References 15: 14 Russian, 1 Western.  
[197-7813]

## CHEMICAL INDUSTRY

### INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY (IUPAC)--INTERNATIONAL COLLABORATION OF SCIENTISTS

Moscow KHIMIYA I ZHIZN' in Russian No 1, Jan 83 p 36

[Report by Z. Samoylova, secretary, National Committee of Soviet Scientists: "IUPAC - International Collaboration of Scientists"]

[Text] The International Union of Pure and Applied Chemistry (IUPAC) was founded in 1919 for the purpose of uniting the efforts of chemists in solving problems requiring international coordination and control. Of primary importance was the search for a common language for chemists--a unified, standardized language which would simplify contact among specialists and would help overcome the variant readings of symbols, terms and units of measurement.

During the first ten years of its existence, thirty countries joined the new union. Now it unites the scientific associations of forty-four countries. Our country is represented by the Academy of Sciences of the U.S.S.R., which established the National Committee of Soviet Chemists for the purpose of communication with IUPAC. Distinguished personalities of Soviet science--academicians A. N. Nesmeyanov, B. A. Kazanskiy, V. N. Kondrat'yev--in various years have joined the directing agencies of IUPAC. From 1967-1969 Academician V. N. Kondrat'yev led the union, as its president. More than forty Soviet scientists--not only chemists, but biologists, doctors, technologists and physicists--have participated in the operation of numerous committees, sections and commissions.

Among the various functions performed by IUPAC, three are constant, most important. First of all, there is the standardization of nomenclature and terminology. Today, when the number of chemical compounds described in the literature exceeds five and a half million and when completely new compounds are being synthesized daily, it simply would be absurd to name them arbitrarily. The nomenclature of chemical compounds must be devised in accordance with specified rules, and the chemist must know these rules and observe them. Otherwise even the most routine exchange of information is impossible, to say nothing of mechanized data processing. IUPAC is even now working out the rules for the systematic nomenclature and terminology. After discussion and approval these rules become mandatory for all.

In order for results obtained in various laboratories to be compared and used for new research, practicable standardized methods for analyzing the composition and structure of substances and identifying trace impurities are necessary. Several IUPAC commissions are proposing such procedures after their thorough experimental verification, and also are giving recommendations as to the presentation of scientific data in print.

IUPAC plays an important role in the critical evaluation of information dispersed over millions of pages of periodical literature. On the basis of this evaluation, international handbooks, tables and data banks are compiled.

All these developments are applicable both in pure chemical science and in applied areas--biotechnology, environmental preservation, pesticide use, as well as in the chemical, medical, nutrition and perfume industries. In recent times such problems as the rational use of natural resources, the search for new energy and raw materials sources, the developments of agricultural production and public health have entered IUPAC's sphere of interests.

The reports of all working sections and management agencies are heard every two years at the General Assembly. The vice-president chosen at the assembly occupies the post of president of IUPAC after two years.

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PROFESSOR NAGAKURA: AMONG THE SCIENCES CHEMISTRY IS THE CHAIRMAN

Moscow KHIMIYA I ZHIZN' in Russian No 1, Jan 83 pp 37-38

[Interview with Professor Saburo Nagakura, president of the International Union of Pure and Applied Chemistry (IUPAC), in Moscow, September 1982, by unnamed correspondents of KHIMIYA I ZHIZN']

[Text] In September of last year Professor S. Nagakura, president of the International Union of Pure and Applied Chemistry (IUPAC), came to Moscow. Correspondents of KHIMIYA I ZHIZN met with him and posed several questions.

[Question] In the June 1982 issue of KHIMIYA I ZHIZN ["Chemistry and Life"] a translation of an article by N. Holden, chairman of one of the IUPAC commissions, was published. The article was entitled "The Atomic Weight Unit: To Be or Not To Be?," and concerned the question as to whether the atomic weight unit of an element should continue to be called "atomic weight," or whether henceforth the term "atomic mass unit" should be used, which more closely corresponds to the spirit of the international unit system (SI). The author noted that the question was of primary scientific significance and held the view that the earlier term more accurately reflected the essence of the matter.

[Answer] I also believe that the term "atomic weight unit" should continue to be used. It has been used for a long time and successfully by scholars of various countries; they have long been accustomed to it; and, finally, this is the correct term.

The problem of unification of terms is extremely topical for chemists, as it is, by the way, for all science as well. Therefore, we approach the solution of such questions with a great sense of responsibility and regard them as one of the most important problems of our union. We also are engaged in the standardization of scientific symbols.

[Question] Uniform symbols and terms, understood identically by all, is only part of the problem of scientific language. In antique times, all scholars wrote their works in Latin and all understood each other excellently. Now, in order to be well informed about scientific events, it is necessary to know several foreign languages straight away. But to study Japanese, for example, is no easy task. Not long ago, by the way, we published a short course in

Japanese for chemists; now KHIMIYA I ZHIZN' is publishing a short course in esperanto. What do you think of the use of this international language as the universal language of science?

[Answer] For the majority of the people of the world, science is part of the national culture. And as such, it must be structured on the basis of the language of that country in which it develops. That is, for reflection, for current work, scientists must use their native language. Naturally, in order to associate with colleagues from other countries, from time to time they must switch to some kind of general language. But practice has shown that for this purpose it is not necessary to invent anything new. Historically, it has developed that in many international organizations English serves as the official language. Sometimes French is used no less successfully. It seems to me that these languages, for the time being, play their role successfully.

[Question] Before you arrived in Moscow, you visited the Novosibirsk Academic Village where science began to develop only approximately a quarter of a century ago. What are your impressions of this young research center?

[Answer] It seems to me that the Novosibirsk Academic Village is a precisely operating scientific organism. And, of course, the rapid economic and cultural development in Siberia is impressive.

The Siberian section of the Academy of Sciences is a very powerful organization, structured according to a well-thought-out plan, introducing large scale investment in the development of both pure and applied branches of science, as well as in the training of young specialists.

As far as I know, in the Soviet Union science and industry often have developed independently from each other. Without going into details, I'll note only that this has both positive and negative aspects. But in Novosibirsk the preparation of specialists for industry is combined harmoniously with the operations of academic institutions, and this seems extremely important to me. And another important thing is that the institutes of the Siberian section are distinguished by having excellent instrument apparatus. But my main observation is that this is all founded on very high quality scientific ideas. This is indeed important. You may buy the most expensive and most complete equipment, but the scientific ideas as to how to use the equipment intelligently cannot be bought for any amount of money.

I was greatly impressed by the level at which the work in the Siberian section was being conducted. A complex, integrated approach to development of chemical research is very valuable. This has fundamental significance in that it ensures applied science and technology effective help from the side of theory and academic science.

[Question] What position does chemistry occupy in the contemporary scientific world?

[Answer] One of my acquaintances says that among sciences, chemistry is the chairman. And I agree with this. Chemistry takes fundamental ideas of

primary importance from physics, transforms them and then transmits them to order branches of science, serving as a communications link among them. Figuratively speaking, chemistry presides in the center--with physics and mathematics on one side, and biology, geology and other sciences on the other.

I think that in the future this communications role of chemistry will increase even more, and as a result its central position will be preserved. Chemistry is the science of molecules. And molecules, perhaps, are one of the most important subjects which science has had to deal with in general, and which all people have to deal with, inevitably, without exception.... It is precisely through molecular research that the most important problems which contemporary natural science and contemporary technology have run into have been resolved. And there is no doubt that such a position will be preserved in the future as well.

As I have already said, the culture of all countries includes science. And science, to be sure, brings a significant contribution to the development of all mankind, helping to raise the standard of living. If science were excluded from our culture, the problem of humanity's adaptation to continuously changing external circumstances would hardly be solvable. It was so in the past, and it will remain so in the future. But, of course, the development of science must correspond to the needs of civilization. It must be done in such a way that the development of science will not harm humanity, which, unfortunately, has sometimes happened, and is happening even now.

This is the reason I attach great significance to the new direction of IUPAC activities--the CHEMRAWN program, adopted in 1975. The title as expanded stands for "Chemical Research Applied to World Needs."

That is, we are speaking of chemical research, directed toward the solution of global problems. We convened the first conference of this program in 1978, in Toronto, Canada. At this conference representatives of the academic and applied sciences, industrial workers and political figures from many countries of the world discussed jointly the problems of fuel and petroleum resources and produced recommendations directed to the governments of countries for whom these questions remain particularly severe. In 1982 in Manila, in the Philippines, the second CHEMRAWN conference convened: "Chemistry, Agriculture and the Supply of Food Products."

And the fact that scientific workers from all over the world are actively participating in the resolution of these vital problems of today immediately answers the question of what good does science do for people.

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DEVELOPMENT OF CHEMICAL SCIENCES IN BELORUSSIAN ACADEMY OF SCIENCES  
(1972-1982)

Minsk IZVESTIYA AKADEMII NAUK BSSR: SERIYA KHIMICHESKIKH NAUK in Russian No 6  
1982 pp 3-9

[Article by V. S. Komarov]:

[Text] Sixty years ago the world's first multi-national socialist state was created, offering all the peoples of former tsarist Russia the chance for free development and the option of choosing their own path. The strengthening of the country's economy, the radical social changes, and the flowering of national culture were inseparably linked to the necessity for profound scientific research; they demanded the creation of local centers for fundamental and applied science, national scientific cadres, and a regionally-based scientific-technical intelligentsia. Such centers exist in all the Soviet republics. These are primarily republic academies of sciences, but also important VUZes and branch scientific establishments, which were a strong stimulus for developing scientific centers in outlying areas of the country.

Currently, the USSR Academy of Sciences works in close conjunction with the republic academies, jointly solving the most important fundamental scientific problems and applied tasks pertaining to the national economy.

In pre-revolutionary Belorussia, there were no scientific-research establishments, or even a single VUZ. Most of the population was illiterate. Today there are more students studying in the republic's 32 VUZes than there were in all of tsarist Russia, and the institutes of the Belorussian Academy of Sciences, founded in 1929 on the basis of the Institute of Belorussian Culture, employ more than 5000 scientific associates, including 219 doctors and 1644 candidates.

A leading place in the scientific programs being implemented in the republic belongs to chemical research, which is closely linked, at the current stage of development, with industry and technology. The connection between chemical science and production determines the success of its development and plays a revolutionizing role: scientific discoveries and developments become the property of production and, conversely, production often stimulates the development of science.

Theoretical and applied research on developing chemical science and chemical technology is being done in the Belorussian Academy of Sciences in the field of catalysis, colloid, inorganic, and bioorganic chemistry, organic synthesis, the chemistry of high-molecular compounds and ion-exchange processes, the chemistry and technology of extracting, processing, and using peat, and so forth.

A fairly complete analysis of the scientific achievements of Belorussian chemists is contained in the books "Nauka BSSR za 50 let" [Science in Belorussia During the Last 50 Years] (Minsk, 1968) and "Akademiya nauk BSSR" [The Belorussian Academy of Sciences], (Minsk, 1979), and in the journal VESTSI AN BSSR, series on chemical sciences, No 6, 1978.

Research at the Institute of General and Inorganic Chemistry in recent decades has been directed at working out the physical-chemical bases and methods of regulating the porous structure of adsorbents, catalysts, and active phase carriers, including high-temperature (1000-1400° C) porous bodies. As a result, scientists have worked out a number of new methods of synthesizing solids with the desired porous structure, and have established the mechanism of processes which take place in hydrogels under the influence of hydro-thermal processing, surface-active substances, magnetic poles, freezing, and so on.

Much work has been done toward developing methods of quantitatively evaluating the acidic properties of the surface of solids, the laws governing their synthesis and determining the catalytic activity of catalysts for ammonia synthesis, the combustion of exhaust gases, the isomerization of cyclohexanone oxime into  $\epsilon$ -caprolactam and modifications of the properties of aluminosilicate catalysts, and determining their activity based on porous structure, acidity, composition, and degree of de-aluminization. A number of interesting results were obtained which have great practical significance aside from their scientific value.

As a result of studying the colloid chemical properties of surface-active substances in saturated salt solutions, scientists at the Beloruskaliy Production Association worked out and partly adopted effective reagent mixture compositions which bind and speed up the technological processes of flotation enrichment of potassium ores and promote the yield of slowly-dissolving forms of potassium fertilizers with improved physical and agro-chemical properties.

They suggested effective compositions for solubilizers and studied the laws governing their action at various technical stages of the flotation process, with the potassium salts hydrophobized with highly aliphatic amines and alkylsulfates. They worked out a completely new type of photographic materials using no silver and possessing a high resolution, color photography properties, and color image. They established the effect of an electric pole on these photo-sensitive materials and elucidated the role of polymer structure in the formation and regression of the latent image. They established the effect of combining photochemical conversions in mixtures of a number of polymers, the "counter effect" under photolysis of cellulose materials and the formation of more than one type of metastable centers in them when exposed to ultraviolet light.

Starting from reaction-active carbon fibers, they created new composition materials with a high thermostability and conductivity, which can be used successfully as antistatic coatings and heaters. They did a substantial amount of research in the field of synthesizing new glass-enamel coatings intended for preventing corrosion in chemical apparatus, metal structures, oil and gas lines, and so forth. They worked out a number of enamel compositions which possess high resistance to acid and alkali, good conductivity, and good technological characteristics.

They synthesized more than 20 new salts of condensed phosphoric acid and showed their effectiveness in synthetic detergents and astringents. In addition, the salts obtained are useful model compounds in agrochemical experiments. They worked out a topochemical method of double tripolyphosphates, which have a number of advantages over the conventional method of obtaining them from aqueous solutions.

A large amount of interesting research of scientific and practical value was carried out in the Belorussian Academy of Sciences Institute of Physical-Organic Chemistry. As a result of many years of research, a new method was worked out of synthesizing quinoline compounds based on the reaction of catalytic condensation of arylidenamines with CH-acids, called the N. S. Kozlov reaction. Many of the compounds obtained have a high generation capacity and thermochromic properties, and find broad application in laser technology and other sectors of the national economy.

A new method was worked out of synthesizing secondary amines with various structures by means of reduction amination of carbonyl-containing compounds with nitriles, oximes, and derivatives of hydrazine. It was shown that this is a universal reaction. A large number of compounds was obtained having a high anti-cholinesterase, anti-virus, and hypotensive effect, and pesticidal activity. In addition, a number of substances which are effective anti-static agents and polymer stabilizers were synthesized.

A new electrochemical method, distinguished by its high technological feasibility and simplicity of instrumentation, was used to synthesize ferrocene, cobaltocene, mercuric organic compounds, acylates and mercurous oxide, and trifluoroacetates of transition metals. A promising method was suggested for synthesizing cyclopentadienes of magnesium and zinc--important intermediate products for obtaining metallocenes and substituted cyclopentadienes.

New methods were worked out for obtaining functionally substituted polychloro-organic compounds based on a trichloroethylene dimer. It was established that many of the synthesized compounds are highly effective pesticides. In reactions of dimerization and dehydrodimerization of polychloralkenes and polychloralkanes, discovery was made of the regrouping of polychloralkyl radicals with migration of chlorine and hydrogen atoms, which has great significance for the theory of homolytic processes.

Extensive research was done on the mechanism and laws governing the liquid-phase oxidation of aromatic compounds, which is the main technique for obtaining valuable oxygen-containing products. For the first time it was

shown that the decarboxylizing of carbonic acids is an equally probable parallel process of the interaction of organic acids with oxygen. New organic and hetero-organic peroxides containing several peroxide groups of various natures in the molecule were synthesized. The compounds obtained are promising as initiators of polymerization.

Research was done on studying the chemical composition of terpenoids produced by certain trees.

A great number of different monoterpenes and also oxygen-containing derivatives of them were synthesized. For example, from  $\alpha$ - and  $\beta$ -pinenes alcohols of a number of epicamphors--epiborneol, epiisoborneol, and others--were synthesized.

In the field of high-molecular compounds, studies were made of the process of chemical modification of polyethylene terephthalate, polyacrylonitrile, and polyethylene in order to obtain fibers and films with improved dyeability, lower inflammability, and increased adhesion capacity. Based on modified polymers, films were obtained which have ion-exchange properties and high plasticity and durability.

Methods were worked out of obtaining the highly effective Microfil polymer microfiltration membranes, intended for fine purification of liquids and gases.

In the field of heterogeneous catalysis, research was done on the laws governing the conversion of organic substances in relation to the nature, composition, and structure of the catalyst. This made it possible to formulate certain concepts about the mechanism of their action.

Studies were made of the relationship between the dislocation mechanism of the course of reactions of solid substances, which proceed through the formation and growth of nuclei of the solid product, on the one hand, and the diffusion mechanism, on the other. It was theoretically shown that the dislocation mechanism is favored by low temperatures, and the diffusion by high temperatures.

Extensive research was done in the field of the thermodynamics of ion exchange, which led to the formulation of a new variation of the theory of ion-exchange equilibria, including those with a random number of exchanged ions. The results of this research formed the basis for the creation of artificial ion-exchange mixtures--nutrition media for plant cultivation.

In the field of the chemistry and the biological activity of the most important biopolymers (protein, nucleic acids, enzyme systems) and low-molecular bioregulants (steroid hormones, prostaglandins, peptides, nucleosides, and so on), the Belorussian Academy of Sciences Institute of Bioorganic Chemistry obtained results which have great scientific and practical value for chemistry, biology, medicine, and agriculture.

Methods were worked out of extracting and purifying to homogeneous consistency the protein components of membrane-connected steroid-hydroxylating systems.

The primary structure of one component of these systems, adrenodoxin (117 amino acid residues). Research on determining the amino acid sequence of cholesterol-specific cytochrome R-450 is nearing completion. The functionally important parts in the native molecule and polypeptide chain of this enzyme have been studied. For selective enzymatic synthesis of corticosteroid hormones, methods were developed for reconstructing functionally active immobilized steroidhydroxylating systems with various substrate specificities.

The structural-functional differences of specific steroid-binding glycoproteins of human blood, taken from the plasma of men, women, and women in childbirth were established. The results obtained testify to the existence of biological mechanisms which provide for the selective penetration of low-molecular hormones into the cells of target tissues.

Domestic medical radiodiagnostic instruments were developed for detecting hydrocortisone, thyroxine, and insulin in human blood and progesterone in cows' milk. An experimental lot of these instruments for clinical testing was prepared.

The mechanism of activating the molecular oxygen of cytochrome R-450 in oxidation reactions of organic compounds of various classes was investigated. The mechanism is of significant interest in evaluating the role of cytochrome R-450 and its individual forms in the metabolism of drugs and carcinogenic substances in humans and animals.

The theoretical premises about the influence of ligands on the helix-knot transition of DNA were developed. These premises have formed the basis for creating a method to study the complexing of DNA with proteins and other biologically active substances.

In the field of nucleoside and nucleotide chemistry (these are the structural units of nucleic acids), new principles of controlling the synthesis of compounds with antitumoral and antiviral action were worked out. Many of the substances synthesized are of interest for medicine as unique instruments for studying metabolic processes.

Research is being successfully conducted on fully synthesizing steroids and their heterocyclic analogs, studying their chemical and pharmacological properties, and establishing the relationship between structure and function. Many of the heterocyclic steroids obtained exhibited antishock, cardiostimulant, and anti-inflammatory behavior in the absence of hormonal action, and look promising as the basis for creating new drugs with selective action on the living organism.

In addition to this, the institute has accomplished the synthesis of the neurohormone luteinizing hormone-releasing hormone (LHRH), (which has great significance in treating hormonal disorders in humans and animals), dieldrin (a neurotropic preparation intended for treating diseases of a pyramidal nature), and chlorthalidone, which has antitumoral effects. Several of the compounds synthesized at the institute have undergone clinical testing and were recommended for use in medical practice.

Scientists at the Institute of Peat worked out the scientific foundations for new technological processes of comprehensive peat processing to obtain fertilizers, biostimulants, feed agents, carbon adsorbents for various purposes, dyes, medical preparations, therapeutic muds, new brands of wax, and products based on them.

With the aim of more rational use of peat for the needs of agriculture the institute suggested methods of preparing peat-gum and granulated organo-mineral fertilizers. Many years of using these fertilizers has shown their high effectiveness on the productivity of various agricultural crops. The secondary action of complex granulated fertilizers, manifested in the stimulation of microbiological and enzyme activity in soddy podzolic soil was also discovered.

Study of the thermochemical processing of peat of a lower degree of decomposition, led to the development and proposal of feed mixtures (yeast foods, sugarized peat, peat-amide concentrate additives) and ways of feeding them to animals. The use of these feed mixtures has benefitted several republic farms.

The institute has completed research on the technology of obtaining peat wax and modified waxes. It was established that it is essential for the republic to organize a major plant for producing peat wax, which is widely used at present in preparing precision casting for melt molds and obtaining release lubricants for the needs of the automobile industry, polishing and protective compounds, chemicals in everyday use, cosmetics, medical preparations, and so forth. Based on an ethanol extract from peat wax tar, they obtained the medicinal agent torphenal, intended for external use in various diseases.

They worked out a theory of self-heating and self-ignition of peat and methods of retarding it, and set a technical-economic base for the republic to organize low-waste processing of peat to obtain yeast foods, sugarized peat, wax, carbon adsorbents, and granulated fertilizers. It was shown that comprehensive processing of peat is 19 times more economically advantageous than using it as fuel.

The institute created a technology for obtaining dye based on gum acids of peat, whose cost is many times lower than the cost of currently used dyes (tonaxyls and aniline dyes) produced in Czechoslovakia. The proposed dye, after extensive production tests, was recommended for use in furniture enterprises of the republic.

The possibility of using suspensions of sapropels as drilling muds in boring wells in salt-saturated deposits was demonstrated, and a method was worked out for stabilizing these muds in order to increase their collective stability.

Scientists put together and published a survey of sapropel deposits in the republic. They gave a genetic classification of sapropels and scientifically substantiated ways of using them in agriculture, industry, medicine, and other fields of the national economy. A major investigation was conducted on the distribution of the republic's peat resources according to basic use trends.

A breakdown of earthen, developed, protected, storage, and reserve resources was provided. The result of this work was that the republic set up specialized reserves and protected areas of raw peat.

The Belorussian Academy of Sciences Institute of Solid-State Physics and Semiconductors, headed by Doctor of Chemical Sciences L. A. Bashkirov, have studied the mechanism and kinetics of the formation of solid solutions of nickel-zinc, nickel-magnesium, and magnesium-zinc ferrites, and also researched phase equilibria in ternary ferrite-forming oxide systems. Based on the research that was carried out, it developed a method for determining the mechanism of ferrite formation and established the optimal conditions for synthesizing ferrites.

The scientists obtained a number of new magnetic semiconductors which are promising for use in electronic devices. Solid solutions of perovskite-like cupri-calcium manganites with a Curie point of 370 K. were synthesized at high pressures and temperatures. It was shown to be possible to obtain a new class of ferromagnetic material--an oxonitride spinel with the partial substitution of oxygen for nitrogen.

The Institute of Atomic Power Engineering, headed by Doctor of Chemical Sciences Yu. P. Davydov, is conducting research on the composition of metal-ions (radioactive elements) in aqueous solutions. The personnel have worked out a new spectrophotometric method for determining the stability constant of mononuclear hydroxo-complexes in solutions, and derived equations which make it possible to determine the degree of poly-nuclear hydroxo-complexes in solutions based on dialysis, spectrophotometry, and ion exchange data.

The laws governing the specific sorption of hydrolyzed forms of metal-ions in adsorbents such as silicagel and ion-exchange tars have been established. The new phenomenon of the reciprocal influence of multi-charged cations on the process of forming poly-nuclear hydroxo-complexes in solutions has been found.

A new variation has been developed for cleaning the radioactive impurities out of products of radiation-chemical synthesis.

The Belorussian Academy of Sciences Institute of Physics, headed by G. P. Gurinovich, corresponding member of the Belorussian Academy of Sciences, is studying the primary processes of photosynthesis. As a result of this research, photochemical ways of obtaining chlorophyll pigments from precursors were found. The staff has elucidated the properties of radicals of tetrapyrrole pigments, which are the most important intermediate forms in oxidation-reduction processes. This made it possible to achieve synthesis of a new type of chlorines, 7,8-tetraalkylchlorines.

New methods were worked out to synthesize meso-substituted porphyrins. Synthesis of porphyrins with an isocyclic ring--the distinguishing structural unit found in natural pigments--was accomplished.

A method to synthesize covalently-bonded dimers of copper complexes of porphyrins was developed. Personnel demonstrated the possibility of removing copper from one part of the dimer, which makes it possible to achieve the profitable synthesis of dimers containing two different metals.



During research on complex compounds, it was established that in the primary process of photochemical oxidation-reduction breakdown of carboxylate complexes of a number of transition metals, elementary derivatives are formed by carbon dioxide elimination. In particular, the five-member glycinate ring of cobalt (III) complexes shrinks to the three-member cobalt-carbon-nitrogen ring. It was shown that an azide ion in the coordination sphere can change into a nitride ion by the photoelimination of a molecule of nitrogen. The photochemical reactions that were discovered were used for the synthesis of new complex compounds.

Much of the scientific-research work of the chemical and geological institutes is being successfully combined with bringing important practical applications and new technological solutions to industrial use. Thus, for example, savings from such innovations have totalled 42 million rubles in the past decade.

Successful implementation is largely due to the close cooperation of chemical institutes and production enterprises, the completion of joint work both on the basis of economic contracts and on contracts of creative collaboration, and, finally, to the practical significance and topicality of new developments and their scientific and technical realization.

In the current five-year plan the institutes of the department have undertaken increased obligations whose fulfillment will result in a significant contribution to the theory and practice of developing scientific trends and to properly usher in the 60-year jubilee of the Union of Soviet Socialist Republics.

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INTERNATIONAL COOPERATION OF SCIENTISTS IN THE USSR IN DEVELOPMENT OF  
ORGANIC CHEMISTRY

Leningrad ZHURNAL ORGANICHESKOY KHIMII in Russian Vol 18, No 12, Dec 82  
pp 2473-2481

KUZNETSOV, V. I. and KLEYEV, B. V.

[Abstract] Writing on the occasion of the 60th Anniversary of the Soviet Union, the authors review the title cooperation within the Soviet Union between its constituent republics, under the guidance of the Academy of Sciences of the USSR. They trace the advances of organic chemistry since the first years of the USSR, when Moscow and Leningrad were the centers of hydrocarbon studies with such scientists as N. D. Zelinskiy, B. A. Kazanskiy, A. F. Plate and others. By the 1930s their leadership brought major research at Baku under Yu. G. Mamedaliyev, in relation to that area's petroleum exploitation, and soon after scientists in Georgia, Armenia and Turkmenia gained reputations in areas such as ammonolysis oxidation to obtain nitriles, isocyanates and isothiocyanates containing phosphorus, and phosphorus compounds with  $P = N$  bonds. In the Ukraine organic fluoride research has led to antiinflammation and hypotension medications, herbicides, etc. In Bashkiria organic sulfur compounds found in local petroleum are being studied, while at Tashkent in Uzbekistan a specialization of importance is alkaloids, as found in *Anabasis aphylla* and quinolizidine-containing plants such as cotton. Basic organic synthesis is studied in Georgia, along with acetylene chemistry, while in Moldavia indole compounds are the concentration. In Latvia, organic synthesis is combined with molecular biology and bioorganic chemistry, including biologically active substances. Also in Riga, beta-diketones are the specialty of some chemists, while others concentrate on adamantanes and derivatives. Other directions in organic chemistry are also cited.

References: 27 Russian.

[135-12131]

## COAL GASIFICATION

UDC 662.74(047)

### THERMOCHEMICAL TRANSFORMATIONS IN PLASTIC ZONE OF COAL

Moscow KOKS I KHIMIYA in Russian No 2, Feb 83 pp 13-18

LAZAROV, L., Institute of Organic Chemistry, Bulgarian Academy of Sciences, Sofia

[Abstract] The thermochemical conversion processes in the plastic zone of coal must be understood in order to develop a theory of coking. The mechanism of coking is closely related to the more general problem of graphitizing of organic compounds and materials with relatively high carbon content. Work has been developed recently in the area of the mechanism of thermal dissolution of coal in hydrogen donor solutions. Studies of the "coal asphaltines" produced have resulted in some changes in our concept of a molecular structure of coal. Coking theory has also been enriched by new concepts. This article discusses the thermochemical transformations in the plastic zone considering data from the area of graphitizability of organic materials and the molecular structure of coal. Anisotropic liquid crystal formations in the plastic zone of coking coal and structural specifics of coking coal are discussed. The mechanism of thermochemical transformations is described. The formation of anisotropic areas in coke is explained. Figures 2; references 27: 9 Russian, 18 Western.  
[185-6508]

UDC 662.74:543.544

### COMPOSITION AND PROPERTIES OF TAR OBTAINED BY THERMAL DEGRADATION OF BSSR SHALE OIL

Minsk VESTSI AKADEMII NAVUK BSSR: SERYYA KHIMICHNYKH NAVUK in Russian No 1, Jan-Feb 83 (manuscript received 1 Jun 81) pp 3-6

MARTINOVICH, K. B., YURKEVICH, Ye. A., LUK'YANOVA, Z. K., BAROVSKAYA, S. N., DROZDOVSKAYA, S. V. and CHEKMAREVA, Ye. D., Peat Institute, BSSR Academy of Sciences

[Abstract] Fractional and group composition of tar obtained from thermal degradation of Turovsk shale oil was analyzed. Following fractions were collected: <100°C (atmospheric pressure); 100-150°C (atmospheric pressure);

150-200°C (20-70 mm Hg); 200-250°C (5-20 mm Hg); 250-300°C (3-5 mm Hg) and  $\geq 300^\circ\text{C}$  (2-3 mm Hg). Analysis of elemental composition, IR, UV spectra and absorption chromatographic data showed that lower and medium fractions contained primarily nonaromatic hydrocarbons. In higher fractions the aromatic and oxygenated derivatives concentrated predominantly. Figure 1; references: 9 Russian (2 by Western authors).  
[194-7813]

UDC 552.578.3:66.014

#### STUDY OF HIGH BOILING SHALE FRACTIONS BY COMBINED IR AND PMR SPECTROSCOPY

Moscow KHIMIYA TVERDOGO TOPLIVA in Russian No 1, Jan-Feb 83  
(manuscript received 6 Apr 81) pp 55-60

CHERNYSHEVA, K. B., RADCHENKO, N. G., NIKITIN, Ye. Ye. and POLOVNIKOVA, I. A.  
Leningrad Engineering-Economic Institute imeni Pal'miro Tol'yatti

[Abstract] Studies were performed by IR and PMR spectroscopy. The method of separating high boiling shale tar fractions into group components allow the production of three groups differing in the content of oxygen compounds: the dephenylated portion, phenols and neutral oils. Evaluation of the group components in the 350-400°C fraction as fuel additives showed that the neutral oils have a positive effect. A more detailed study of the molecular structure of these neutral oils is undertaken. The mean characteristics of molecular structure are determined for narrow oil fractions. It is shown that the fractions differ both in aromaticity, location and type of alkyl substituents in the aromatic rings and in nature of functional oxygen groups. Fractions boiling at 400 to 450°C have elevated content of chemical structures characteristic of aromatic ketones, quinoid groups, alkylated phenols. They are more aromatic and have long aliphatic substituents. The combination of these molecular structures must be considered the active origin of the effectiveness of the anticorrosion action of the shale tar additives.  
References: 7 Russian.  
[169-6508]

UDC 662.7(088.8)

#### COAL HYDROGENIZATION INITIATORS

Moscow KHIMIYA TVERDOGO TOPLIVA in Russian No 1, Jan-Feb 83  
(manuscript received 10 Feb 81) pp 111-113

KRICHKO, A. A., DEMBOVSKAYA, Ye. A. and GORLOV, Ye. G., Institute of Fossil Fuels

[Abstract] Results are presented from studies of the influence of the addition of certain organosilicon compounds of both ring and line structure in pure form and in technical mixtures on the process of hydrogenization of coal.

The experiments were performed in autoclaves at 420 to 430°C, hydrogen pressure 10 MPa. Hydrogenization of brown coal containing 1 to 5% organosilicon compounds resulted in a depth of transformation of organic coal mass 5 to 14% higher depending on the nature of the reagents. Most effective is octamethylcyclotetrasiloxane, which has cyclic structure, and a trimethylvinylsilane, which has an unsaturated double bond. The depth of transformation of the organic coal material increases when they are present from 73 to 84-86%. The substances added can not only localize active radicals before they are stabilized with hydrogen, but, also, activate the reaction of destruction of the organic coal matter and generate atomic hydrogen, thus transforming radical polymerization reaction inhibitors to activators and hydrogen carriers. References 8: 4 Russian, 3 Western, 1 East European.  
[169-6508]

## GAS COMBUSTION UNDER STATIC CONDITIONS

Moscow KHIMICHESKAYA FIZIKA in Russian No 2, Feb 83  
(manuscript received 10 May 82) pp 254-263

AZATYAN, V. V. and SHAVARD, A. A., Institute of Chemical Physics, USSR  
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[Abstract] Combustion kinetics under static conditions in the pressure interval from the first to the second ignition limit was studied on the example of oxidation of hydrogen. A predetermined quantity of  $2\text{H}_2 + \text{O}_2$  was rapidly valved into a reactor which had been evacuated and heated to the test temperature. The pressure and chemiluminescence were recorded by a high speed precision method. It was found that recombination forming  $\text{H}_2$  is not the only reaction of H atoms as  $\text{H}_2$  burns with  $\text{O}_2$ . The stoichiometry of the chain process is not equal to the stoichiometry of the gross reaction  $2\text{H}_2 + \text{O}_2 = 2\text{H}_2\text{O}$ . If the stoichiometry is not disrupted, this means that all sorbed hydrogen atoms react with  $\text{O}_2$  during the time of combustion. In either case the significance of chemisorbed hydrogen which does not recombine to form  $\text{H}_2$  is great in the process of combustion. Self-inhibition of combustion occurs, with the active participation of  $\text{H}_2\text{O}$  molecules formed. Consideration of the inhibiting effect of  $\text{H}_2\text{O}$  vapor alone, however, does not explain the fact that the experimental value of  $\Delta T$  is an order of magnitude less than the calculated value. A factor not previously considered is involved: the presence of a small volume of connecting tubes near the reactor, into which a portion of the gas is forced, resulting in a lesser increase in gas pressure than would obtain without this ballast volume. Previous calculations not considering this factor cannot describe the actual process which occurs. Figures 4; references 23: 20 Russian, 3 Western.  
[183-6508]

## IGNITION OF LIQUID IN EVACUATED GLASS TUBE WITH AIR JET

Moscow KHIMICHESKAYA FIZIKA in Russian No 2, Feb 83  
(manuscript received 21 May 82) pp 264-271

DOROFEYEV, Ye. I. and KONDRIKOV, B. N., Moscow Institute of Chemical Technology  
imeni D. I. Mendeleev

[Abstract] The ignition of a fluid with cavitation and compression of gas inclusions was experimentally studied. The source of action was an air jet bursting into an evacuated tube containing an organic fluid capable of spontaneous combustion. Experiments were performed primarily with nitric acid esters of ethylene glycol, diethylene glycol and glycerine. The experiments indicate that when a jet of air acts on a fluid capable of combustion in an evacuated glass tube, four means of heating of the gas inclusions occur: 1) compression of the gas cavity by the moving fluid; 2) cavitations; 3) collapse of bubbles with a sharp increase in pressure; and 4) penetration of the jet of air into the fluid layer, formation and great compression of a gas cavity in the depth of the layer near the bottom of the tube. In all cases ignition was observed only for ethylene glycol and glycerine derivatives. Diethylene glycol dinitrate, nitromethane and trinitromethylbenzene (melt) did not flash. Figures 3; references 6: 5 Russian, 1 Western.  
[183-6508]

UDC 536.46:541.125

EVOLUTION OF COMBUSTION FOCUS IN NEAR LIMIT MIXTURE AND LIMITED VOLUME  
CONCENTRATION LIMITS OF COMBUSTION

Moscow KHIMICHESKAYA FIZIKA in Russian No 2, Feb 83  
(manuscript received 22 Jul 82) pp 272-281

MAKHVILADZE, G. M., Institute of Mechanics Problems, USSR Academy of Sciences,  
Moscow

[Abstract] Development of a flat (one horizontal dimension much greater than another) combustion focus in near saturated mixtures of various compositions is studied for a simple chemical transformation system with one reacting component. The process of evolution of the focus is studied in a closed vessel with an insulated upper wall for two combustion systems corresponding to initiation of chemical reaction in the lower portion of the vessel and in the immediate vicinity of its upper boundary. The results of the mathematical modeling experiment performed indicate that the concentration of carbon monoxide in a vessel with a thermally insulated upper wall is 6.5% CO with an initial height of the source of 2 cm and combustion from the bottom, 5.8% CO with an initial height of the source of 9 cm and combustion from the top. The rise time of the focus with combustion from the bottom is 0.26 s, with combustion from the top 0.05s. Figures 3; references 16: 15 Russian, 1 Western.  
[183-6508]

## HEAT SPONTANEOUS COMBUSTION OF GASEOUS MIXTURES WITH HETEROGENEOUS INITIAL CONCENTRATION

Moscow KHIMICHESKAYA FIZIKA in Russian No 1, Jan 83  
(manuscript received 26 May 82) pp 108-112

MAKSYUTOV, Sh. Sh., NOVOZHILOV, B. V. and TSYGANOV, S. A., Institute of Chemical Physics, USSR Academy of Sciences, Moscow

[Abstract] An important factor influencing combustion of gaseous mixtures in technical installations is heterogeneity that leads to focal points in burning. The authors studied the imbalance caused by spatial modulation of initial reagent concentrations through calculations that indicated that at the moment of ignition and subsequent burning of a mixture along the flame front, the entire mixture does not burn due to its failure to blend. Where the lack of homogeneity does not exceed a certain critical point, however, spontaneous combustion takes place in a manner that is practically homogeneous. As the imbalance becomes more pronounced, burning changes until it takes on the focal point feature of combustion. Figures 5; references 6: 4 Russian, 2 Western.  
[142-12131]

## MECHANISM OF METHYLAMINE BURNING IN ATOMAR OXYGEN FLAME

Moscow KHIMICHESKAYA FIZIKA in Russian No 1, Jan 83  
(manuscript received 23 Apr 82) pp 113-120

BASEVICH, V. Ya., KOGARKO, S. M. and TYURIN, A. N., Institute of Chemical Physics, USSR Academy of Sciences, Moscow

[Abstract] As one of the simpler amino-substituted hydrocarbons, methylamine is used separately for burning or as an additive to fuels. Yet it is still complex, and knowledge of its features and possible ecological effects is of importance and has received considerable study. In one series of tests the authors varied temperature and measured the burning rate of  $O + CH_3NH_2$ , taking into account oxygen losses to secondary reactions. The lack of dependable data on burning rate constants make the data generated somewhat undependable, although it is useful for estimates. Further tests examined the contribution of each elemental act to the process of conversion of  $CH_3NH_2$  and separately selected components of the reaction. From this it was learned that formation of NO had little activation energy and required an oxygen-rich atmosphere to form NO from a molecule containing nitrogen. The overall calculations bear witness to a noticeable difference in kinetic behavior of comparable systems. Figures 4; references 34: 10 Russian, 24 Western.  
[142-12131]

## CRITICAL THERMAL IGNITION CONDITIONS IN FILTRATION OF REACTIVE SUSPENSIONS

Moscow TEORETICHESKIYE OSNOVY KHIMICHESKOY TEKHNologii in Russian Vol 17, No 1, Jan-Feb 83 (manuscript received 25 Dec 80) pp 133-134

PORTNOV, L. P., FILIPPOV, G. G., IVANOV, L. P. and GORBUNOV, A. I.

[Abstract] The theory of thermal explosion is used to analyze critical situations arising upon filtration of reactive suspensions at the transition from the washing to gravitational separation stages and to determine safe operating conditions for a filter. In contrast to the usual approach in which the critical conditions are determined by the quantity of solid phase, critical conditions are found based on the reactive component of the liquid phase. Three equations are derived for analysis of critical conditions of thermal ignition. The area of safe parameters of filtration can be found from the condition that the heat liberation speed is less than the speed with which heat is carried away. Three conditions are calculated, any one of which assures safe filtration. References: 3 Russian.

[168-6508]



## FERTILIZERS

UDC 631.83

### MINERAL FERTILIZER INDUSTRY IN BELORUSSIA

Minsk IZVESTIYA AKADEMII NAUK BSSR: SERIYA KHIMICHESKIKH NAUK in Russian  
1982 pp 9-15

[Article by Kh. M. Aleksandrovich, Institute of General and Inorganic Chemistry, BSSR Academy of Sciences "Current Status and Prospects for Future Development of the Mineral Fertilizer Industry in Belorussia"]

[Text] Production is the central problem of the current decade both in the economic and in the political plan. In connection with the decisions of the 26th congress, the May 1982 Plenum of the CPSU Central Committee reviewed and approved the USSR Food Program for the period through 1990. This program is the most important component of the party's economic strategy for the next decade. Its goal is to provide food products to the country's population reliably, in the shortest possible time. This can only be done on the basis of rapid development of output of the national economy, since it is this that makes the starting basis for a cardinal solution of the food problem.

Great and important tasks for the further development of agriculture were confronted at the July 1978 and May 1982 Plenums of the CPSU Central Committee and the July 1978 Plenum of the Communist Party, which reviewed questions of agricultural development in our country and republic, and at the November 1981 CPSU Central Committee Plenum, Sixth Session of the USSR Supreme Soviet, and Fourth Session of the BSSR Supreme Soviet, tenth convocation, which discussed the 1981-1985 state plan for the country's economic and social development.

The most important conditions for successful realization of the USSR Food Program are more rapid scientific-technical progress, highly effective use of production potential, and strengthening the material-technical base of agriculture and all sectors of the agroindustrial complex by further developing mechanization and chemization in production, and by extensive land reclamation. Thus, basic production resources in agriculture will increase by a factor of 1.5; the energy capacity in kolkhozes and sovkhoses will increase by a factor of 1.6, and rural supplies of mineral fertilizers will increase by a factor of 1.7 in 1985 and double in 1990. The area of irrigated lands is expected to reach 23-25 million hectares in 1990.

In raising the effectiveness of agricultural production at present and in future periods, a significant role by the chemical industry, since the use of

its products (mineral fertilizers, chemical agents to protect plants, and microbiological products) plays a major role in the upsurge and continued growth of agricultural productivity.

The ever-growing role of the chemical industry has demanded that the speed of its development be continually increased. The period following the May 1958 CPSU Central Committee Plenum, at which it was decided to speed the development of the chemical industry and the chemization of the national economy, and which was a major landmark in the history of the chemical industry, is characterized by great achievements in creating and improving the technical base of this sector of the national economy, and in the organization and quickened development of its new production facilities, including the production of mineral fertilizers. Thus, in 1957, the Soviet Union produced eight million tons of mineral fertilizer (standard units); in 1970, 55.4 million tons; in 1975, 90.2 million tons; and in 1980, 104 million tons. In 1985, the production of mineral fertilizer will increase by 47 million tons, or 45 percent of the 1980 figure. Such rates of development of the mineral fertilizer industry are unheard of in any other country in the world. The agricultural supplies of mineral fertilizer grew correspondingly. In the past 15 years (since the 1965 CPSU Central Committee Plenum) they have tripled and in the ninth and tenth five-year periods they amounted to 306 and 400 million tons of fertilizer, respectively. In 1985, based on 100 percent of the needed nutrients, agriculture will have to be provided with 26.5 million tons of mineral fertilizer, and in 1990 with 30-32 million tons.

The need for producing such a large quantity of mineral fertilizer and introducing it into the soil is caused by the fact that when agricultural crops are harvested a great quantity of nutrients is taken out of the soil. Thus, for an average annual gross yield of grain, the amount of nutrients taken out is as follows: nitrogen ( $N_2$ )--7.3 million tons, phosphorus ( $P_2O_5$ )--2.6 million tons, potassium ( $K_2O$ )--5.5 million tons, or a total of 15.4 million tons, which corresponds to 70-75 million tons of fertilizer. Intensive plant cultivation speeds up the process of removing these elements still more. If you take into account the incomplete assimilability and substantial leaching (40-50 percent) of fertilizers, the necessity for systematically putting mineral fertilizers into the soil becomes obvious. The 77 million tons of fertilizer per year put in recently in the Soviet Union only halfway compensated for the nutrients which went to make the harvest.

The mineral fertilizer industry in the USSR was especially intensively developed in the 10th Five-Year Plan. New capacities were installed for the production of 36.5 million tons of fertilizer. Compared to the eighth and ninth five-year periods, the structure of the fertilizer output changed as follows: nitrogen accounted for 48 percent, phosphorus--33 percent, and potassium--19 percent. The share of complex and concentrated fertilizers in 1980 as compared with 1975 rose from 74 to 80 percent, and the average content of nutrients increased from 35.6 to 37.5 percent.

The USSR Food Program has set measures for further raising the quality of mineral fertilizers. By 1990 the output of highly concentrated and complex fertilizers will make up at least 90 percent of the total volume of production,

and beginning in 1988 fertilizers for agriculture will be produced only in granular or large-crystal form. The production of liquid complex fertilizers based on superphosphoric acid is being expanded. A broad program of works will be implemented to raise the technical level of the mineral fertilizer industry and create highly effective production lines, apparatus and equipment with large unit capacity. The program calls for increasing the responsibility of the agrochemical service for effective use of mineral fertilizers and other chemization methods, and for bringing into production the achievements of science, technology, and progressive experience.

A great contribution to the all-union production of mineral fertilizers is also made by the chemical industry of Belorussia, which occupies one of the leading places among the economic regions and union republics. In the 10th five-year period the output of chemical products in the republic (in terms of cost) increased by a factor of 1.5, primarily due to the growth in mineral fertilizer production. In the 11th five-year period the production of mineral fertilizers will be increased by a factor of 1.3 and potassium fertilizers in particular by a factor of 1.4, thanks to which the republic will keep its position as the main supplier of mineral fertilizers, especially potassium.

Potassium fertilizers. In the production of potassium fertilizers, the Soviet Union has held the first place in the world since 1968. Its share of world production amounts to about 30 percent. In 1980 19.4 million tons (41.6 percent  $K_2O$ ) were produced. The average amount of  $K_2O$  contained in potassium fertilizers in 1980 was 52.4 percent, as opposed to 49.4 percent in 1975. The granulometric condition of the  $KCl$  was improved; the percentage of commercial grade material (1-4 mm class) increased to 75-80 percent as compared with 55 percent in 1975. The output of granular potassium fertilizers reached 3.6 million tons.

The main output of potassium fertilizers in the Soviet Union (about 80 percent) is concentrated in the Uralkaliy and Beloruskaliy Production Association enterprises, which produce fertilizers in the form of potassium chloride based on sylvinit ore from the Verkhnekamskiy and Starobin potassium fields. The yearly capacity of each of these enterprises is more than twice the capacity of analogous foreign enterprises. Before the war the Solikamsk Potassium Plant, with a capacity of 0.33 million tons, was the only one operating in the Soviet Union. In 1954 the Berezniki Plant, with an equal capacity, was set in motion. Now in the Urals, Belorussia, and the Ukraine, there are 11 potassium ore mining administrations and plants, with a capacity in excess of 20 million tons of fertilizers.

The Belorussian potassium basin has significant reserves of potassium salts: combined with the probably reserves they are evaluated at 80 billion tons. This sets up the prerequisites necessary for the further growth of fertilizer production. The Beloruskaliy Production Association is processing more than 30 million tons of sylvinit ores per year, producing more than 8 million tons of potassium fertilizers. In the 10th five-year period Plant No 4 in Soligorsk, with a capacity of 1.7 million tons per year, was made operational, and the ore mining administrations Nos 1 and 3 of the Beloruskaliy Production Association were expanded. These enterprises are distinguished by a high technical level. For the first time in the world, mines have adopted a selective system of mining potassium beds with continuous extraction, which

raises the level of potassium salts recovered from 50 to 70 percent with a simultaneous increase by a factor of 1.5 in the percentage of useful material in the ore mined. A composite method was adopted with selective extraction of the stratum of the third potassium seam, completely working out the long breakage faces of the upper layer and with comprehensive extraction of the lower seams. Using progressive extraction technology with long breakage faces and modernized coal combines, the recovery of ore at the Beloruskaliy Production Association mines has reached 12-13 million tons per year.

Natural sylvinite ores are a mixture of minerals of sylvine (KCl) 22-27 percent, halite (NaCl) 70-80 percent, and clay-carbonate impurities 2-10 percent. Processing them is accomplished by flotation and halurgic methods. At halurgic enriching factories (Solikamsk No 1, Berezniki No 1, Soligorsk No 4) the separation of KCl from ore occurs as a result of dissolving a mixture of salts in water at a temperature of 105°C and the subsequent crystallization of KCl by chilling the solution and vacuum evaporating it. The flotation process of enrichment used at Beloruskaliy Production Association enriching factories No 1, No 2, and No 3, and at Uralkaliy Production Association factories No 2 and 3, is based on separating KCl and NaCl salts by floating fine grains of KCl in baths into which dispersed air has been pumped. To create the conditions so that KCl minerals adhere to the air bubbles while NaCl and the clay portions do not adhere to them, the crushed ore in a saturated KCl and NaCl solution is processed by surface-active substances (reagents) which act specifically on these components of the ore. To hydrophobize the grains of KCl, higher aliphatic amines are used as reagents; to hydrophilize the clay portions, so-called "protective" colloids are used--cellulose esters, starch, ureaformaldehyde resins, and so forth. Improving the flotation enrichment process of potassium ores calls for seeking new, inexpensive, plentiful, and non-toxic reagents for selective flotation of ores and lowering the caking tendency of potassium fertilizers, for raising the KCl content and improving its recovery from ores, and for effective dehydration of the clay-salt sludge in order to eliminate the sludge deposits and the accumulating excess of salt water.

Some urgent scientific-technical problems of producing potassium fertilizers are developing and applying selective extraction of potassium interlayers from salt layers in order to raise the content of KCl and lower the clay impurities in the extracted ore; developing effective systems of working out deposits in order to lower potassium ore losses in the depths of the earth; increasing the recovery of useful material during the enrichment of potassium ores; improving the quality of potassium fertilizers both in KCl content and in granulometric composition; and, also, protecting the environment from salinization by the solid or liquid wastes of potassium production. In this connection, one promising method is to implement underground selective leaching of KCl minerals while leaving NaCl and barren rock in the earth, and also working out a dry method (electrostatic in particular) for enriching potassium salts which does not employ a liquid phase or salt solutions and can be used in the mine.

Phosphorus fertilizers. Phosphorus is the second element, after nitrogen for nourishing plants and is called the "element of life and thought" by Fersman. Its concentration in soil is lower by a factor of 10-15 than that of

potassium and a factor of 2-3 lower than that of nitrogen. Phosphorus is an element of protoplasm, bone, enzymes, hormones, and vitamins. It is indispensable for organic synthesis, in cell division processes, and in the propagation and transmission of hereditary traits. Lowering the phosphorus content of soil results in lowering the crop yield, and productivity of livestock, and poorer quality in products of animal husbandry.

Unlike potassium and nitrogen, which are partly returned to the soil in manure and as a result of linkage with specific bacteria and cultures, phosphorus comes into the soil basically only through fertilizers. So the development of the phosphorus fertilizer industry is one of the first tasks in agricultural chemization. The extensive development of this production is difficult for two reasons.

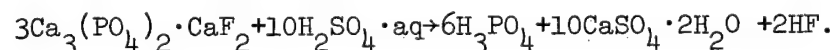
Worldwide sources of raw phosphate are limited. The known deposits of raw phosphate are as follows (in billion tons): Morocco--21, Soviet Union--17.7, United States--13.6, Tunisia--2, and Algeria--1.02. The high-quality apatite concentrate (39.4 percent  $P_2O_5$ ) of the Khibinskiy deposit amounts to about 80 percent of the raw phosphate of the USSR and other socialist countries; the Kara-Tau basin has lesser value, as yet. In the past 3 decades geologists have not discovered any significant sources of phosphate ores in the USSR.

Obtaining phosphorus fertilizers from raw phosphate involves the consumption of great quantities of sulfuric acid, but the production of it in the USSR now supplies less than half the amount required by the national economy.

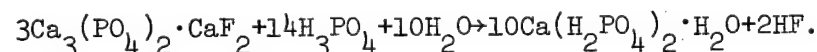
In the manufacture of phosphorus fertilizers, the Soviet Union holds second place in the world, behind the United States. In consumption it is first. Soviet agriculture's need for phosphorus fertilizers is currently being less than halfway filled.

The Belorussian fertilizer industry also makes a substantial contribution to the production of phosphorus fertilizers. The Gomel Chemical Plant is producing phosphorus fertilizers, based on apatites, in the form of double superphosphate  $Ca(H_2PO_4)_2 \cdot H_2O$  (300,000 tons per year with a  $P_2O_5$  concentration of 44-47 percent), ammophos  $(NH_4)_2HPO_4 + (NH_4)HPO_4$  (540,000 tons with  $P_2O_5$  concentration 50 percent and  $N_2$  concentration 11 percent), and also a fertilizer mixture in the proportions K:P:N equals 1:1:1 (100,000 tons per year).

Apatite  $3Ca_3(PO_4)_2 \cdot CaF_2$  interacts with sulfuric acid when heated according to the following reaction:



By the interaction of apatite with concentrated phosphoric acid we obtain double superphosphate:



Using double superphosphate--concentrated fertilizer--makes it possible to economize significantly on materials.

In the field of phosphorus fertilizer production, one important scientific-technical problem is the use of lean phosphate ores for obtaining phosphoric acid or elementary phosphorus. Working out more economical methods of processing raw phosphate appears promising. This includes electrothermic production of phosphorus and later refining it into concentrated orthophosphoric  $H_3PO_4$  (52-56 percent  $P_2O_5$ ) and polyphosphoric acids, for example, tripolyphosphoric acid  $H_5P_3O_{10}$  (72-76 percent  $P_2O_5$ ), which are promising raw

material for obtaining highly-concentrated and complex fertilizers such as potassium tripolyphosphate or ammonium tripolyphosphate-- $K_5P_3O_{10}$ ,

$(NH_4)_5P_3O_{10}$ , and others, and also the hydrothermic method of producing defluorinated phosphates (by treating with water vapor at 1450-1550°C), which makes it possible to convert natural phosphates into an easily assimilable form and obtain fertilizers without using acids.

Nitrogen fertilizers. Nitrogen is a component of protein, chlorophyll, nucleic acids, vitamins and hormones--that is, it is primarily contained in the seeds and fruits of agricultural crops. Most of the nitrogen in the soil (up to 99 percent) is in the form of organic compounds in humus, insoluble in water, and therefore unavailable to plants. The amount of nitrogen returned from the atmosphere is 3-4 kilograms per hectare per year. Nitrogen-fixing bacteria bind an average of 5 kilograms/hectare of nitrogen per year. About 20 percent of the nitrogen taken up by grain crops is returned to the soil. So in order to systematically raise the harvest yield, according to Pryanishnikov, it is necessary to return to the soil at least 80 percent of the nitrogen taken from it.

The main source of raw material for industrial nitrogen fertilizers is atmospheric nitrogen, which is combined into ammonia by the reaction  $N_2 + 3H_2 \rightarrow 2NH_3$ . The majority of the nitrogen-producing enterprises, including the Azot Production Association (in Grodno), use hydrogen from natural gas. The main stages in ammonia synthesis are air separation to obtain nitrogen, high-temperature conversion of methane, conversion of carbon monoxide and elimination of carbon dioxide, and catalyzed ammonia synthesis to obtain ammonia water. The USSR produces 14 million tons of ammonia per year, 80 percent of which is used to make various types of nitrogen fertilizer. The main types of nitrogen fertilizer produced in the USSR (including at the Azot Production Association) are ammonium nitrate  $NH_4NO_3$  (containing 35 percent  $N_2$ ), carbamide or urea  $CO(NH_2)_2$  (46 percent  $N_2$ ), and ammonium sulfate  $(NH_4)_2SO_4$  (21 percent  $N_2$ ). In 1980, the Azot Production Association produced 300,000 tons of ammonium nitrate, 600,000 tons of urea, and 170,000 tons of ammonium sulfate.

Ammonia oxidizes to nitrogen oxides by the reaction  $2NH_3 + 3O_2 \rightarrow NO + NO_2 + 3H_2O$ .

When dissolved in water the oxides form weak nitric acid by the reaction  $4NO_2 + O_2 + 2H_2O \rightarrow 4HNO_3$ . Ammonium nitrate is the result of reacting ammonia with

nitric acid. Urea in liquid form is obtained by reacting ammonia with carbon dioxide  $2\text{NH}_3 + \text{CO}_2 \rightarrow \text{CO}(\text{NH}_2)_2 + \text{H}_2\text{O}$ , and ammonium sulfate is obtained by neutralizing sulfuric acid with ammonia.

The use of liquid ammonia as a nitrogen fertilizer appears promising. In the United States about 50 percent of nitrogen fertilizers are put into the soil in the form of liquid fertilizers. Using liquid ammonia for this purpose has a great advantage over solid fertilizers. It saves 30 percent in capital expenditures for equipping enterprises which produce nitric acid and ammonium nitrate, and the prime cost of the nitrogen in ammonia is 30 percent lower than nitrogen in solid nitrogen fertilizers.

In the 11th and 12th five-year periods, the nitrogen fertilizer industry will create high-power facilities for synthesizing 450,000 tons of ammonia per year, use atomic reactors for thermal energy, and set up enterprises which will simultaneously produce ammonia and carbamide. The search will continue for methods of fixing atmospheric nitrogen in nitric acid and its salts with oxygen, by-passing the inconvenient and complex stage of obtaining ammonia. It looks promising, for example, to obtain nitrogen oxides in a plasma jet with rapid cooling of reaction products, and also to form nitrogen oxides in the presence of metallo-organic catalysts at ordinary temperatures and pressures.

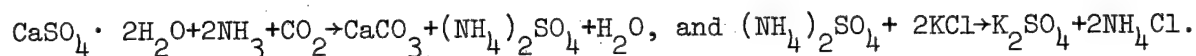
In the future the mineral fertilizer industry in the Soviet Union, including Belorussia, will undergo intensive further development. In 1985 the USSR's potassium fertilizer production will expand (compared to 1980) by 40 percent and reach 30 million tons per year. In 1990, 37 million tons will be produced, with an increase of nutrient in the preparations of up to 58-59 percent  $\text{K}_2\text{O}$ . It is proposed that, by 1990, Belorussia begin producing (compared to 1980) 50 percent more potassium fertilizers, 10 percent more nitrogen fertilizers, and 5 percent more phosphorus fertilizers. In the future the most important scientific-technical problem in the mineral fertilizer industry will be increasing the production of concentrated fertilizers, which should reach 43 percent by 1985 and 45 percent by 1990. The economic effect of raising the nutrient content in fertilizers by just one percent amounts, for an average transport distance of 1000-kilometers, to 400,000 rubles per million tons of fertilizer. The major portion of fertilizer should be produced in granular form, which is convenient for bulk transportation. It is proposed that in 1985 potassium fertilizers be produced only in granular and large-crystal form. The production of liquid fertilizers will be developed. The existing ratio of nutrients in complex fertilizers is  $\text{N}:\text{P}_{2\text{O}_5}:\text{K}=1:0.08:0.7$ .

By 1990 it will be  $1:0.9:0.8$ . Plans call for increasing the assortment, particularly to perfect the technology of preparing nitro-ammophoska--by breaking down apatite concentrate with nitrogen oxides--and long-acting carbamide-formaldehyde fertilizers.

Another important problem is obtaining chlorine-free potassium fertilizers. The presence of chlorine in fertilizers has a detrimental effect on the quality of agricultural products--for example, lowering the starch content in potatoes. Sulfates appear to be the most promising for obtaining chlorine-free fertilizers by reactions which exchange  $\text{KCl}$  for other salts which do not



contain chlorine. In Belorussia, a sulfate that can be used for this purpose is gypsum  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ —a waste product from phosphorus fertilizer production at the Gomel Chemical Plant, known as phosphogypsum. Chlorine-free fertilizer can be obtained by the following reactions:



The carbon dioxide ( $\text{CO}_2$ ) needed for the reaction is also a waste product at the Azot Production Association. Accomplishing the process by the indicated reactions poses no difficulties, although the problem of utilizing ammonium chloride ( $\text{NH}_4\text{Cl}$ ) does arise.

Another very important problem is the effective use of mineral fertilizers provided for agriculture. According to data for this country and abroad, only an average of 50 percent of the fertilizer applied goes into the crop. The remainder leaches out of the soil with ground water or rain, and becomes linked to compounds which have low assimilability for plants. This leads to significant fertilizer losses and the contamination of pond, lake, and river waters. So, along with the proper choice of forms and methods of putting fertilizers into the soil, it is urgent to use fertilizers which have a regulated solubility in soil and maximal assimilability for plants. By introducing various film-forming additives to fertilizers it is possible to lower the loss of nutrients and raise their effectiveness.

Solving these scientific-technical problems in the mineral fertilizer industry is an essential condition for successfully intensifying agricultural production in our country.

#### SUMMARY

The state-of-the-art and prospects for development of the mineral fertilizers industry in the USSR and BSSR are elucidated. The urgent scientific-engineering problems to be resolved in the field of production and utilization of mineral fertilizers are discussed.

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CSO: 1841/186

UDC 63:54(47+57)

DEVELOPMENT OF CHEMIZATION OF AGRICULTURE IN THE USSR AND AGROCHEMICAL  
SCIENCE TASKS

Moscow AGROKHIMIYA in Russian No 12, Dec 82 pp 3-8

MINEYEV, V. G. and YANISHEVSKIY, F. V.

[Abstract] The successes achieved in the development of agriculture are definitely related to increasing use of chemicals. The use of mineral fertilizer was responsible for every 5th ton of grain, every 3rd ton of cotton, every 8th ton of sugar beet and sunflower seed, every 10th ton of potatoes and vegetables during the 10th Five Year Plan. Organization of the National Scientific-Production Union "Soyuzsel'khozkhimiya" and creation of the special ministry for the production of mineral fertilizers, which has responsibility for development of the production and delivery of mineral fertilizers and chemical plant-protection substances, indicate the great significance of this area in agriculture. The most important tasks of agrochemistry at present include: scientific development of standards for profitability of the use of mineral fertilizers; improvement of methods of spreading of mineral fertilizers; determination of the most effective means and times for application of fertilizers; agrochemical demonstration of the creation of new forms and improvement of existing mineral fertilizers; development of scientifically well-founded indices for soil fertility; development of fertilization systems for crop rotation; improvement of the application of organic fertilizer; improvement of methods of chemical reclamation of soils; testing of the chemical composition of soils and waters; standardization and automation of methods of agrochemical analysis of soils and plants.

[156-6508]

UDC 63:54(477)

PRIMARY TRENDS AND RESULTS OF AGROCHEMICAL RESEARCH IN THE UKRAINE

Moscow AGROKHIMIYA in Russian No 12, Dec 82 pp 9-20

DMITRENKO, P. A.

[Abstract] Trends in agrochemical research include determination of soil and agrotechnical conditions which, considering the specifics of crops and properties of fertilizers, allow the best utilization of fertilizer to increase

the fertility of soil and quality of products. Two methods of calculating fertilizer doses have become most widely used in the Ukraine: the first is based on quantitatively-estimated functions relating the change in harvest to the content of mobile forms of nutrient substances in the soil; the second method calculates fertilizer doses based on observed harvest increases resulting from increased fertilizer applications. Experiments performed in the Ukraine in recent years are briefly and generally described. Comprehensive increases in the efficiency of fertilization are called for. Optimization of fertilizer doses is seen as a significant aspect of this problem. In the final analysis the solution of the problems at hand will produce results for further improvement of fertilizer systems which must be based in each case on computation of the planned harvest, and intensification of agriculture in all areas. [156-6508]

UDC 631.811.2:631.416.2:633.15

INFLUENCE OF PHOSPHATIZING CONDITIONS ON CONTENT OF VARIOUS PHOSPHORUS COMPOUNDS AND ACCUMULATION OF NUTRITIOUS ELEMENTS IN CORN PLANTS

Moscow AGROKHIMIYA in Russian No 10, Oct 82 (manuscript received 11 Nov 81)  
pp 23-28

BUNYAKIN, I. Ya. and BUNYAKINA, R. F., Krasnodar Kray Station for Use of Chemicals in Agriculture

[Abstract] The purpose of the study was to determine the level of phosphorus in the soil at which phosphorus metabolism is disrupted in corn plants and how zinc and other elements are accumulated under these conditions. Vegetation experiments were also used to study the influence of forms of phosphorus fertilizers as well as zinc and magnesium on the harvest and accumulation of elements by corn plants. The experiments were performed in carbonaceous low-humus, low-clay chernozem:  $pH_{aq}$  7.9-8.1, total absorbed based 35.6-39.0 meq/100 g, carbonate  $CO_2$  0.75%, humus 3.8-4.1%, mobile phosphorus and metabolic potassium 0.8-1.1 and 34-36 mg/100 g. The results indicated that the main criterion for judging the maximum permissible phosphorus content in the soil and its concentration in the plants is the harvest. There is a complex dependence between mineral phosphorus and zinc, mineral phosphorus and manganese and also between zinc and manganese. Increasing the phosphorus content to the threshold quantity facilitates significant accumulation of total phosphorus and decreases organic phosphorus in relationship to mineral phosphorus, decreases the quantity of zinc and increases manganese content. Zinc sulfate restores phosphorus metabolism while decreasing the uptake of phosphorus, potassium and manganese by the plants. Manganese sulfate increases the accumulation of nitrogen, phosphorus and potassium. Zinc accumulates primarily in the roots. References 11: 8 Russian, 3 Western. [158-6508]

## EFFECTIVENESS OF RED PHOSPHORUS AND ITS MIXTURES

Moscow AGROKHIMIYA in Russian No 11, Nov 82 (manuscript received 28 Jul 81)  
pp 44-48

BEZUGLAYA, Yu. M., KOZHEMYACHKO, Z. V., RYABIZINA, T. Ye. and  
KHATSIYEVA, N. V., Scientific Research Institute of Fertilizers,  
Insecticides and Fungicides imeni Ya. V. Samoylov, Moscow

[Abstract] Red phosphorus is a slow acting fertilizer with long after-effect. The  $P_2O_5$  of red phosphorus when applied with a catalyst is assimilated by plants during the year applied; without a catalyst it becomes available 3 to 4 years after application. Multiannual field experiments on the effectiveness of red phosphorus and its mixtures with simple superphosphate were performed in a soddy podzolic medium loam soil. The red phosphorus powder was mixed with solid copper at 1% of the red phosphorus on the day of application as a catalyst. Red phosphorus was found to have no effect when annually applied before planting. It was most effective when applied in reserve. The most responsive crops were potatoes and winter wheat. Mixtures with 32-38% superphosphate. The vegetation method revealed that phosphate accumulated in the soil had strong after-effects on rye grass harvest, equivalent to that of double superphosphate. References 8: 5 Russian, 3 Western.  
[157-6508]

UDC 631.41:631.811

## ESTABLISHMENT OF OPTIMAL MOBILE PHOSPHORUS CONTENT IN SOIL AND FERTILIZER CONSUMPTION FOR ITS ACHIEVEMENT

Moscow AGROKHIMIYA in Russian No 11, Nov 82 (manuscript received 16 Sep 81)  
pp 49-55

BERKHIN, Yu. I. and CHAGINA, Ye. G., Siberian Scientific Research Institute of Soil Science and Chemization of Agriculture, Siberian Branch, All-Union Agricultural Scientific Research Institute, [VASKNIL], Novosibirsk

[Abstract] A study is made of biologic  $P_{opt}$  levels required to achieve the maximum harvest of a given crop. This may or may not be the economically optimal phosphorus level. The optimal phosphorus content was determined by conducting experiments with artificially-created phosphorus levels, produced by various doses of superphosphate. The soil was composted with increasing doses of finely-milled double superphosphate under laboratory conditions at the optimal moisture content, for one month. It was found that the optimal phosphorus content varied from 6 to 24 mg  $P_2O_5$  per 100 g. It was frequently higher than in soils of the European portion of the country. The optimal level corresponds to an approximate consumption of 200-400 kg phosphorus per hectare. References 8: 7 Russian, 1 Western.  
[157-6508]

## ACHIEVEMENTS IN DOMESTIC MINERAL FERTILIZER INDUSTRY

Moscow AGROKHIMIYA in Russian No 12, Dec 82 pp 36-44

NOVIKOV, A. A. and CHUB, I. F.

[Abstract] At least half the increase in harvests have resulted from application of mineral fertilizers. The costs of production and application of fertilizer are paid for two or three times over by the value of the additional agricultural products produced. The production of all mineral fertilizers has increased from 7.4 million tons in 1965 to 24.76 million tons in 1980. In 1980, the USSR produced more mineral fertilizer than the USA. Fertilizer plants producing high quality mineral fertilizer are named. Important advances for the future include expanded production of combined fertilizers and the creation of a broad fertilizer mixing network in the nation, allowing great increases in the effectiveness of utilization of mineral fertilizers in agriculture considering the specific properties of local soils and more rapid implementation of the food production program. References 8: 5 Russian, 3 Western.

[156-6508]

## FREE RADICALS

UDC 541(24+64)

### FREE RADICAL CONVERSIONS OF POLYETHYLENETEREPTHALATE INITIATED BY PHOTO-ACTIVE ADDITIVES

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 25, No 1, Jan 83  
(manuscript received 2 Aug 81) pp 144-149

DAVYDOV, Ye. Ya., PARIYSKIY, G. B. and TOPTYGIN, D. Ya., Institute of Chemical Physics, USSR Academy of Sciences

[Abstract] To expand knowledge of the title conversions the authors used electron spin resonance to study free radicals that were responsible for destruction of cross-linking of polyethyleneterephthalate (PETP) in a process inhibited by photodecomposition of benzoyl peroxide and iron chloride. Irradiation of the polymer with light-containing additives caused photo-reduction of  $\text{FeCl}_3$  and photodecomposition of benzoyl peroxide, leading to corresponding Cl atoms and phenyl radicals that at low temperatures could generate macromolecules. Poor resolution made it impossible to separate ESR spectral components, and consequently the photodissociation method was verified by photolysis of ethylbenzoate with added  $\text{FeCl}_3$ . In PETP, the cyclohexadienyl radicals should have a structure in which the unpaired electron is localized on phenyl rings that are cross-linked macromolecules. Other radicals were also identified, of polyene types. A diverse process of free radical conversion in which many photochemical and thermal reactions simultaneously lead to destruction and cross-linking of macrochains was observed. Figures 4, references 7: 4 Russian, 3 Western.  
[145-12131]

UDC 541.117

### STUDY OF KINETICS OF DIFFUSION-CONTROLLED RECOMBINATION OF FREE RADICALS IN SOLID PHASE BY MONTE-CARLO METHOD

Moscow KHIMICHESKAYA FIZIKA in Russian No 1, Jan 83  
(manuscript received 2 Jul 82) pp 131-133

KLOCHIKHIN, V. L., PSHEZHETSKIY, S. Ya. and TRAKHTENBERG, L. I., Scientific Research Physicochemical Institute imeni L. Ya. Karpov, Moscow

[Abstract] Various explanations of the kinetics of free radical recombination have been offered; a likely suggestion is that heterogeneity of initial

distribution, and propose a simple formula to describe recombination kinetics that describes the kinetic patterns obtained in a machine experiment successfully. Mathematically it is stated that around a simple cubic gridwork with a given time interval, migration of free valencies occurs until, meeting neighboring systems, they recombine and disappear. Where the number of free radicals is too small, they recombine according to a law of the second order. With heterogeneous initial distribution of free valencies in volume, diffusion occurs until dimensions are reached where recombination can again be explained by the law of the second order. The authors claim that their theoretical calculations and computer experiments agree. Figures 2, references 8: 6 Russian, 2 Western.

[142-12131]

UDC 541.124

#### CALCULATION OF CONSTANT OF RECOMBINATION RATE OF $\text{PH}_2$ RADICALS

Moscow KHIMICHESKAYA FIZIKA in Russian No 1, Jan 83  
(manuscript received 1 Jun 82) pp 61-65

ZAKHAR'IN, V. I., NADTOCHENKO, V. A. and TEYTEL'BOYM, M. A., Chernogolovka Department, Institute of Chemical Physics, USSR Academy of Sciences

[Abstract] Previously the authors used the method of intraresonator laser spectroscopy to determine the recombination rate constant for  $\text{PH}_2$  radicals obtained by flashphotolysis of phosphine (DOKLADY AN SSSR, 1982 Vol 263, No 1, p 127). In the present study they used a statistical theory of monomolecular reactions to calculate the role of pressure of recombination rate constant of  $\text{PH}_2$  radicals and the trimolecular constant at low pressures. Basic equations and parameters of the diphosphine and the activated complex are presented. Calculations for two models showed that the geometric structure of activated complexes is analogous to the molecule  $\text{P}_2\text{H}_4$  with the exception of the distance between phosphorus atoms. Rotation of the diphosphine molecule and the activated complex around the P-P axis is regarded as active, while rotation around the two remaining main axes is seen as adiabatic. The analysis showed that experimental and calculated results can be reconciled at high pressures if the accepted extreme recombination rate constant is  $7 \cdot 10^{-11}$  reduced by ca. 20%. At the high experimental pressures retarding features and swirl had no significant impact. Figure 1; references 14: 7 Russian (3 translations?), 7 Western.

[142-12131]

## ION EXCHANGE PHENOMENA

CERTAIN TRENDS IN DEVELOPMENT OF CHEMISTRY AND TECHNOLOGY OF ION-EXCHANGE MATERIALS (FOR THE 70th BIRTHDAY OF KIRILL MAKSIMOVICH SALDADZE)

Moscow PLASTICHESKIYE MASSY in Russian No 1, Jan 83 pp 62-64

VALOVA-KOPYLOVA, V. D. and TULUPOV, P. Ye.

[Abstract] The authors review the accomplishment of the leading specialist in ion-exchange studies in the USSR on the occasion of his 70th birthday, 2 Dec 1982. His career began before World War II and continued during that period while he served in the army. His wartime inventions involving ion-exchange materials, which contributed to the Soviet war effort, found their continuation in studies of high-molecular compounds involving these materials. Overall physicochemical, physicomachanical and kinetic properties were tied to practical uses, such as predicting optimal conditions for using ionites at high temperatures and theoretical principles for creating thermally durable ionic materials for nuclear technology and organic synthesis. Saldadze showed that ion-exchange materials are both high-molecular chemically active polymers that bring ion transfer and that they are involved in other accompanying or secondary processes, serving as ionites, complexities, redoxites, and molecular sorbents. The deprotonated form of most ionites was shown in contact with transitionals to serve as a ligand whose polymer nature and trimer structure determine complex formation. Saldadze also worked on modifying ionites for specific applications and on describing properties of solutions, selectivity and isotherms of ion exchange to determine specific properties and effects. Enthalpy, complex- and precipitate-formation were studied by microcalorimetry. Practical applications included purification of sewage from industrial plants and desalinization of sea water. Saldadze also made significant contributions to scientific organizations, particularly the Scientific Council for Chromatography of the USSR Academy of Sciences.  
[141-12131]



STUDY OF STRUCTURE OF PERFLUORINATED SULFOCATION-EXCHANGE MEMBRANES BY  
NMR-RELAXATION OF  $^{19}\text{F}$  AND PARAMAGNETIC SOUND METHODS

Moscow KHIMICHESKAYA FIZIKA in Russian No 1, Jan 83  
(manuscript received 6 Apr 82) pp 49-53

VOLKOV, V. I., GLADKIKH, S. N., TIMASHEV, S. F., SMIRNOV, N. I.,  
MUROMTSEV, V. I., ANDREYEVA, A. I. and TIMOFEYEV, S. V., Scientific Research  
Physicochemical Institute imeni L. Ya. Karpov, Moscow

[Abstract] The title membranes have promise in electrochemical technology due to their selectivity and electrical resistance, which in turn depend on the membrane matrix structure, the distribution of functional groups and the liquid phase state of the membrane. The authors studied a perfluorinated ion-exchange membrane and kinetics of ion and water molecule transfer using ESR data of  $\text{Cu}^{2+}$  and  $\text{Mn}^{2+}$  and NMR-relaxation of  $^{19}\text{F}$  nuclei of polymer matrixes of MF-4SK with exchange volume of 1.12 mg-equiv/ml. Temperature, moisture content and ion exchange of  $\text{Na}^+$  onto  $\text{Cu}^{2+}$  ions were related to the bivalent copper ions' ESR spectra, which showed significant clustering reaching  $10^{19}$  ion/cm<sup>2</sup>. The perfluorinated membranes were shown to have structural variations that affected distance between clusters, and that distance as well as cluster dimensions were measured. Experimental data and calculated values agreed with theoretical models. Figures 2; references 23: 11 Russian (2 translations?), 12 Western.  
[142-12131]

## NITROGEN COMPOUNDS

UDC 662.764.074.39:546.267.542.938

### HYDROLYSIS OF HYDROGEN CYANIDE IN AMMONIA SOLUTIONS

Moscow KOKS I KHIMIYA in Russian No 2, Feb 83 pp 33-35

KAMENNYKH, B. M., NAZAROV, V. G., RUS'YANOVA, N. D. and LEBEDEVA, G. N.,  
All-Union Institute of Coal Chemistry

[Abstract] Laboratory studies were used to estimate the thermal transformations of HCN in concentrated ammonia solutions obtained in complex coking gas purification installations with liberation of anhydrous ammonia. The experiments utilized an aluminum reactor in a glycerine thermostat with a temperature range of 90 to 140°C. During the experiments samples of the solution were taken at uniform time intervals as the solution was held in the reactor without agitation at a constant temperature. The results produced indicate that in complex gas purification systems utilizing this method most of the hydrogen cyanide extracted from the gas in the stage of regeneration of absorption solutions and processing of ammonia solutions is hydrolyzed at elevated temperatures, after which the product of hydrolysis is distilled away. The reaction products not distilled during desorption can be extracted during exchange of a portion of the solution in the absorption-desorption cycle and converted along with excess water by the usual methods. Figures 4; references 4: 3 Russian, 1 Western.

[185-6508]

UDC 517.491.1

### REACTION OF ASYMMETRICAL DIALKYLHYDRAZINES WITH DIISOCYANATES

Leningrad ZHURNAL ORGANICHESKOY KHIMII in Russian Vol 18, No 12, Dec 82  
(manuscript received 31 May 82) pp 2547-2549

SHEVCHENKO, V. V., KLIMENKO, N. S. and VASIL'YEVSKAYA, G. A., Institute of  
Chemistry of High-Molecular Compounds, UkSSR Academy of Sciences

[Abstract] Polymers containing the title group have certain specific properties; their introduction into the basic polymer chain is based on use of bis(1,1-dialkylhydrazides) of dicarboxylic acids. Yet aminoimides based on derivatives of 1,1-dialkylsemicarbazides feature supplementary stabilization. To obtain polyfunctional compounds of the latter type, the authors studied the reaction of a double molecular excess of several asymmetrical dialkylhydrazides

with distinctive alkyl radicals, with hexamethylene- and p,p'-diphenylmethanediisocyanates. The reaction occurred rapidly and yielded large amounts of 1,1-disubstituted bis-semicarbazides independent of the order in which reagents were added, but with di(2-hydroxyethyl) hydrazine, it was preferable to add diisocyanate to dialkylhydrazine. Infrared spectral data and chemical procedures are summarized. References 6: 4 Russian, 2 Western. [135-12131]

UDC 547.239.1+547.29

#### SYNTHESIS OF $\alpha$ -ACYLHYDROXYALKYLISOCYANATES

Leningrad ZHURNAL ORGANICHESKOY KHIMII in Russian Vol 18, No 12, Dec 82  
(manuscript received 1 Jun 82) pp 2614-2615

FETYUKHIN, V. N., VOVK, M. V. and SAMARAY, L. I., Institute of Organic Chemistry, UkSSR Academy of Sciences, Kiev

[Abstract] In reactions with organic acids, isocyanates are known to produce amides or symmetrical ureas. The authors found, however, that  $\alpha$ -chloroalkylisocyanates reacted with carboxylic acids, preserving the cumulene fragment, and producing previously unknown  $\alpha$ -acylhydroxy. The reaction took place without heating, in ether and in the presence of triethylamine. With heating above 120°C, carbon dioxide was emitted and acylimines formed. Chemical procedures are summarized. Compounds were confirmed by infrared and  $^{19}\text{F}$  NMR spectra. [135-12131]

## ORGANOPHOSPHORUS COMPOUNDS

UDC 661.719

### SYNTHESIS AND SOME PROPERTIES OF O,O-DIALKYLSELENOPHOSPHORIC ACID SALTS

Kiev UKRAINSKIY KHIMICHESKIY ZHURNAL in Russian Vol 49, No 2, Feb 83  
(manuscript received 25 Feb 82) pp 181-184

MEL'NIK, Ya. I., Lvov State University imeni I. Franko

[Abstract] Reaction of dialkylphosphorous acids and selenium with alkali metals and ammonium carbonates and acetates yielded respective salts of O,O-dialkylselenophosphoric acids. These salts were shown to react with electrophilic reagents (butyl and ethyl bromide, acetic acid chloride) leading to formation of selenophosphoric acid derivatives. It was shown that alkylation of these salts occurred at the selenium atom, while acylation took place at the oxygen. The purity of these products was supported by TLC data and the structures were proposed on the basis of IR spectra and independent syntheses. References 8: 5 Russian (1 by Western author), 2 Polish, 1 Western. [197-7813]

UDC 542.91:547.1'118:547.558.2

### INTERACTION OF BIS( $\alpha$ -OXYETHYL)PHENYLPHOSPHINE WITH PHENYLARSINOXIDE AND DIMETHYLPHENYLARSENATE

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 1, Jan 83 (manuscript received 14 Jul 82) p 235

YERASTOV, O. V., ROMANOVA, I. P. and CHADAYEVA, N. A., Institute of Organic and Physical Chemistry imeni A. Ye. Arbuzov, Kazan Branch, USSR Academy of Sciences

[Abstract] The replacement of an hydroxyalkyl group in phosphines with an arsenic-containing radical is described. The interaction of bis( $\alpha$ -hydroxyethyl) phenylphosphine with phenylarsin oxide or dimethylphenylarsenate produces a crystalline product corresponding in composition to phospharsobenzene. The product is determined to be hexylphenyl=1,3,5-triphospha-2,4,6-tri-arsacyclohexane. [162-6508]

CONSERVATION OF VALENCE OF PHOSPHORUS ATOM IN CHLORAL PLUS PYROCATECHINTRI-  
FLUOROACYLPHOSPHITE REACTION PRODUCT

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 1,  
Jan 83 (manuscript received 21 Jul 82) p 236

KONOVALOVA, I. V., OFITSEROV, Ye. N., MIRONOV, V. F. and PUDOVNIK, A. N., Kazan  
State University imeni V. I. Ul'yanov-Lenin

[Abstract] For the first time the authors have reacted pyrocatechintrifluoro-  
acylphosphite with chloral to produce an adduct in which the phosphorus atom  
retains its valence. When equimolar quantities of pyrocatechintrifluoro-  
acylphosphite are heated with chloral at 100-120°, pyrocatechin-O-( $\alpha$ -trifluoro-  
acyloxy- $\beta,\beta,\beta$ -trichloroethylphosphite is produced with a yield of 40%.

Reference 1.

[162-6508]

## PESTICIDES

UDC 547.832.5+632.952.951.2

### STUDY OF PESTICIDAL AND GROWTH REGULATING ACTIVITY OF 3-ARYLBENZO[f]QUINOLINIUM DERIVATIVES

Minsk VESTSI AKADEMII NAVUK BSSR: SERYYA KHIMICHNYKH NAVUK in Russian No 1, Jan-Feb 83 (manuscript received 14 May 82) pp 64-69

KOZLOV, N. S., ZHIKHAREVA, O. D., ANDREYEVA, Ye. I., SMIRNOVA, G. K. and SHAPOVALOV, A. A., Institute of Physical Organic Chemistry, BSSR Academy of Sciences; All-Union Scientific Research Institute of Chemical Plant Protective Agents, Moscow

[Abstract] Fungicidal, insectoacaricidal and growth regulating activities of simple and quaternary salts of styryl- and anilino vinyl derivatives of 1,2-alkyl-3-(R-phenyl)benzo[f]quinolinium have been reported. In fungicidal tests, the evaluated compounds showed medium to high activity in controlling Botrytis cinerea fungus, but poor activity in respect to other test objects. Against phytopathogenic agents only 1-methyl-3-(p-acetoxyphenyl)benzo[f]-quinoline and styryl derivative of benzo[f]quinolinium showed average activity. Other compounds were not effective. As contact insecticides and acaricides these compounds were active only against mites and ticks. Several of these derivatives tested could be classified as plant growth regulators.

References: 15 Russian.

[194-7813]

UDC 632.915

### WHEAT DISEASES

Moscow ZASHCHITA RASTENIY in Russian No 2, Feb 83 pp 24-25

CHUMAKOV, A. Ye., department head, All-Union Institute of Plant Protection

[Abstract] Saturation of crop rotation schemes with one or a few crops and the selection of varieties for highest harvest without considering natural disease resistance have resulted in a great increase in the loss of wheat to plant diseases. The use of tolerant and resistant strains, zoned systems of wheat protection and effective prediction of the development of harmful organisms can greatly improve the harvest. Methods of disease prediction using multispectral scanners on weather satellites, television and remote harvest evaluation systems are now under development. Agroecologic conditions in various zones of the country must be considered in organizing industrial-scale grain production.

[161-6508]

## OPTIMAL HERBICIDE DISTRIBUTION

Moscow ZASHCHITA RASTENIY in Russian No 2, Feb 83 pp 26-27

ZAKHARENKO, V. A., doctor of agricultural sciences

[Abstract] Every ruble invested in the nationwide program--in which 47,000 collective and state farms report the use of herbicides and wheat infestation rates over a total area of 280 million hectares, resulting in the production of nationwide weed maps--produces five additional rubles of agricultural production. An important part of the work is determination of areas in which the weed content is greater than the threshold at which the use of herbicides becomes economically feasible. The next stage is determination of areas infested with weeds resistant to the standard herbicides used. The author has developed a program implementing a simplex method algorithm which can find the optimal version of utilization of herbicides under conditions formulated as a system of linear equations. The equations used in the system are presented and briefly analyzed. The problem of herbicide distribution has been solved using a Minsk-32 computer based on weed infestation data from farms in Kalinin Oblast.

[161-6508]

## INCREASE TESTING OF NEW PESTICIDES

Moscow ZASHCHITA RASTENIY in Russian No 10, Oct 82 pp 36-37

SHUROVENKOV, Yu. B., director, All-Union Scientific Research Institute of Plant Protection, KRASNYKH, A. A., laboratory chief, and GULIDOVA, L. A., senior scientific associate

[Abstract] This article discusses an earlier article on accelerated study and introduction of new pesticides. The authors call for expanded testing of new pesticides involving not only toxicology laboratories and plant research institute stations but also branch research institutes, experiment stations, planning research stations and other institutions, which should study the new pesticides under various soil and climatic conditions on large numbers of crops in short periods of time, with simultaneous determination of pesticide residues and the effect on the harvest. The fact that the state commission has stopped publishing annual results of its operations has created great difficulties. Primary attention throughout this article is given to the need to develop and more rapidly introduce pesticides to control the most harmful plant pests, rather than the need to test pesticides to ensure their safety for agricultural workers and the eventual consumers of the agricultural products.

[159-6508]

## INCREASING AVIATION CHEMICAL TREATMENT EFFECTIVENESS

Moscow ZASHCHITA RASTENIY in Russian No 8, Aug 82 pp 8-9

SHISHKO, A. Ya., department chief, "Soyuzsel'khozkhimiya" Association

[Abstract] Soyuzsel'khozkhimiya concludes agreements with aviation enterprises as a customer, with farms as a contractor. This organizational plan allows farms to utilize the benefits of air-delivered agricultural chemicals without allocating personnel for this purpose. Operating staffs develop and approve aviation chemical operating plans to assure proper distribution and effective utilization of fixed wing aircraft and helicopters across the nation. Planned work is proceeding on the creation of a well-developed network of airfields for aerial agrochemical operations. Where hard-surface airfields are scarce, local feeder line airfields can be used to set up agricultural air spraying bases. There is a shortage of ground loading equipment for the aircraft, but its production is being accelerated. Most spraying is still done by the obsolete An-2 aircraft. Modernization has increased its productivity by a factor of 1.5 and decreased operating costs by 30%, but new aircraft are still needed.

[160-6508]

UDC 632.95.026

## TASKS OF HYGIENISTS

Moscow ZASHCHITA RASTENIY in Russian No 8, Aug 82 pp 9-10

KRYZHANOVSKAYA, M. V., department leader, All-Union Research Institute of Hygiene, Toxicology, Pesticides, Polymers and Plastics

[Abstract] Performance of the tasks set before preventive medicine for the 11th Five-Year Plan related to implementation of the state program for the use of chemical and biological plant protection substances, growth regulators and mineral fertilizers will require clear coordination of the actions of public health organizations, ministries of agriculture, chemistry and mineral fertilizer production. Coordination and interdepartmental delineation of tasks and means for their performance to exclude duplication are necessary. Hygienists must create, develop and apply new safe means of chemical protection, develop effective approaches for the control of pests in intensive agriculture, assimilate and introduce effective methods of increasing soil fertility, and for combined utilization of soil resources, the development of scientific and technical principles and combined measures for improvement of the use of protection of water resources of the nation and their territorial distribution, create and assimilate new technological processes and systems of equipment for mechanization and automation of forestry operations, develop safe labor conditions, reduce injury and disease rates of agricultural workers, reanalyze standards for protection of the air, water and soil from pollution, develop highly effective means and methods for diagnosis, treatment and prevention of human malignancy, etc. Some specific areas of study are briefly and generally listed.

[160-6508]



UDC 665.765-404:892.093/094

DEVELOPMENT OF ASSORTMENT STANDARDIZATION OF MODERN LUBRICANTS FOR LIQUID FRICTION BEARINGS

Moscow KHIMIYA I TEKHNLOGIYA TOPLIV I MASEL in Russian No 1, Jan 83 pp 6-8

BADYSHTOVA, K. M., GRIGOR'YEVA, N. I. and IVANKINA, E. B., KF [expansion unknown-Faculty of Kinetics??], All-Union Scientific Research Institute for Petroleum Processing

[Abstract] Currently domestic Soviet producers call for lubricating bearings with low-sulfur oils, without additives, with 6, 14, 20 or 28 mm<sup>2</sup>/sec viscosity at 100°C. Increased loads and speeds have indicated the need for better lubricants such as Mobil Vacuoline 100, Shell Vitrea or Total Cortize. The authors studied various alternative lubricants and additives for viscosity, temperature, deemulsifying and corrosion properties. Tests indicated that viscosities could be limited to 6, 17 and 28 mm<sup>2</sup>/sec at 100°C. Improved viscosity and temperature parameters were found for oils from high-index base oils and additives produced in western Siberia; these blended oils had 20-50% better load-carrying ability than unblended counterparts. The oils were tested successfully at the "Elektrostal'tyazhmash" (Electrosteel Heavy Machinery) Production Association, and are considered suitable for high-production modern rolling mills and other contemporary lubrication tasks. Figure 1, references 6: 4 Russian, 2 Western.  
[140-12131]

UDC 665.622.4

PERFECTING DESALINIZATION PROCESSES IN ELECTRICAL DESALINIZATION SYSTEMS OF PETROLEUM PROCESSING PLANTS

Moscow KHIMIYA I TEKHNLOGIYA TOPLIV I MASEL in Russian No 1, Jan 83 pp 8-14

BERGSHTEYN, N. V., KHUTORYANSKIY, F. M. and LEVCHENKO, D. N., All-Union Scientific Research Institute for Petroleum Processing

[Abstract] Since chlorides in oil being processed lead to hydrochloric corrosion of equipment and to down time, the authors studied the various types of equipment available for removing such impurities, which include vertical, spherical and horizontal electrodehydrators in series or separately. Advantages and drawbacks of each type are presented. Spherical types accept only

low pressure (0.6-0.7 MPa), while vertical ones are generally outmoded. One problem of the preferred horizontal electrodehydrators, the suspension insulators, is being corrected by producing them of high-durability fluoroplastics. A modern installation of two banks of four such dehydrators each is described, and discussion also covers factors of temperature and pressure, type and consumption of deemulsifiers, flushing water feed and mixture of petroleum with flushing water, for petroleums from Romashka, Prikamsk, Mangyshlaks and Turkmen oil deposits. Recommendations include provision for thorough flushing and mixing of petroleum and water, experimental determination of required deemulsifier use and feed, adjustment of alkalinity to pH 7, procedures for reducing desalinization temperatures, especially for West Siberian oils, increasing productivity, and replacing vertical electrodehydrators with modern horizontal ones equipped with fluoroplastic suspension insulators. References 42: 36 Russian, 6 Western.  
[140-12131]

UDC 665.7.038:66-932

#### CONSTANT PHOSPHOROSULFUR TREATMENT IN PRODUCING DITHIOPHOSPHORUS ADDITIVES

Moscow KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL in Russian No 1, Jan 83 pp 17-18

SERGEYEV, G. I., KOVALENKO, V. P., LITOVCHENKO, N. R. and KUPKO, G. G.,  
VNIIPKneftekhim [All-Union Scientific Research Institute for Petrochemical?]

[Abstract] Transition from antiquated "batch" production to modern constant flow technology for zinc-dithiophosphorus additives is held up by temperature and hydrodynamic aspects of maintaining a constant feed of  $P_2S_5$  during the two-stage exothermal reaction. The authors developed a pilot system featuring an auger feeder that is operated by a hydraulic motor. Test operation with a 6-8% excess of  $P_2S_5$  yielded 95-96% of theoretical dialkyldithiophosphoric acid production. Results support full production, with the auger feeder for  $P_2S_5$  consisting of a double-axis conveyor belt to simultaneously homogenize and feed the raw material. Excess amounts of phosphorus pentasulfide assured more rapid production. Figure 1; references 5: 2 Russian, 3 Western.  
[140-12131]

## PREDICTING PROTECTIVE EFFECTIVENESS OF TRANSMISSION FLUIDS

Moscow KHIMIYA I TEKHNLOGIYA TOPLIV I MASEL in Russian No 1, Jan 83 pp 22-23

CHECHETKIN, V. V., ZASKAL'KO, P. P., KUZNETSOV, Ye. G., BOSENKO, A. I.,  
ROMANOVSKAYA, A. A. and PIROGOV, Yu. N.

[Abstract] Experience has shown that transmission fluids intended to prevent corrosion during prolonged storage of vehicles are not always effective. Standard ratings for such lubricants do not even approximate actual corrosion protective dependability, and thus the authors sought to develop a reliable rating system. Observations of many years as well as laboratory tests indicated that a 10% addition of the corrosion inhibitor AKOR-1 extended the protection to as much as 8 years under high-moisture conditions and 0.9 years in an electrolyte. The basis for calculations is presented. Figure 1; references: 7 Russian.

[140-12131]

## VACUUM LUBRICANTS BASED ON NEUTRAL OIL

Moscow KHIMIYA I TEKHNLOGIYA TOPLIV I MASEL in Russian No 1, Jan 83 pp 23-25

ARTEM'YEVA, V. P., POTANINA, V. A., KUCHERYAVAYA, N. N., ORLOVA, S. N. and  
GORBACHEVA, S. G., All-Union Scientific Research Institute for Petroleum

[Abstract] Basic parameters for high-vacuum pumps such as minimal residual pressure, rapid operation and vacuum collapse resistance depend on type and properties of hydraulic fluids, which include mineral oils, esters of organic alcohols and acids and organic silicon compounds. Mineral oils have been used most because of their thermal stability and low cost. This article reports studies of such oils based on domestic naphthene-paraffin hydrocarbons and medical vaseline processed from Balakhan petroleum. Neutral naphthene oil with 90% saturated hydrocarbons was found suitable for vacuum oils after purification and distillation. Its origin as a by-product of sulfonate additive production, and resultant low cost, recommend this oil for full production. Figures 2, references 4: 1 Russian, 3 Western (patents).

[140-12131]

## FLUIDS FOR HIGH PRESSURE HYDRAULIC SYSTEMS

Moscow KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL in Russian No 1, Jan 83 pp 25-26

KONOVICH, L. G., ZHURBA, A. S. and FURMAN, A. P., VNIIPKneftekhim [All-Union Scientific Research Institute for Petrochemical?]

[Abstract] Recent increases in operating pressure for hydraulic systems has called for improved fluids with viscosity, temperature, antifoaming and anti-oxidation qualities that assure long-service. Viscosity must contribute to prevention of leakage; foreign hydraulic fluids accomplish this with surface-active substances containing alkaline rare-earth metals and thickeners, and the authors sought to achieve similar results. They developed a fluid named "MGP-80" with the desired parameters, which surpassed "Kollag" in dispersing capacity, critical seizing resistance and fusing load. No corrosion in hydraulic systems was observed, and it could be mixed freely with the foreign fluids "Kollag" and "Molikot". References 6: 4 Russian, 2 Western (patents). [140-12131]

UDC 665.765-404.035.5

## EFFECT OF RESIDUAL COMPONENTS ON STABILITY OF LUBRICANTS TO OXIDATION

Moscow KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL in Russian No 1, Jan 83 pp 29-30

BOROVAYA, M. S., MOROZOVA, I. A., LEPESHKINA, Yu. S. and AVED'YAN, S. V., All-Union Scientific Research Institute for Petroleum Processing

[Abstract] Motor oil use properties are governed both by additives and by the base composition, which determines compatibility with additives and oxidation tendency. The authors studied low-sulfur petroleum from the Volgograd and Mangyshlaks oil fields, and sulfuric oils composed of a mixture of Volga-Urals oil or mixtures of West Siberian, Kamenolozhskaya and Kungurskaya oils. Results showed that mixtures of distillate, stable residual components of sulfuric oils produced stable lubricants, while those of low-sulfur oils were unstable. A standard method used to measure effects of components on stability and oxidation products showed that the carbenes and carboids that resulted when low-sulfur oils were used were absent when mixed components were used. Thus, lubricant stability was enhanced by use of components from petroleum with higher sulfur content, and the combination of aromatic hydrocarbons with organic sulfur compounds played an important role in this stability. References: 2 Russian. [140-12131]

## ROLE OF AMINE STRUCTURE IN PROTECTIVE CAPACITY OF CORROSION INHIBITORS

Moscow KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL in Russian No 1, Jan 83 pp 31-32

FOKIN, A. V., POSPELOV, M. V., CHURSHUKOV, Ye. S., MAYKO, L. P., LEVICHEV, A. N., GUS'KOVA, O. V. and SHEBRAKINA, S. V., Institute of Physical Chemistry, USSR Academy of Sciences

[Abstract] The mechanism of amine effects in corrosion inhibitors has not been explained completely, but is related to surface activity. The authors evaluated the contribution of structural factors of aliphatic amines with various substituents to the protective effect of the compounds as oil-soluble corrosion inhibitors. Amines tested included N-trifluoroacetyloctadecylamine, N-trifluoroethyloctadecylamine, N-octadecyldiethylamine, N-octadecylethylamine and several diethylalkylamines. A polarizational resistance method was used to measure rate of corrosion. Results showed some protective effect with tertiary amines, but only for about 1.5 hours. The protection increased markedly as the transition from amine  $C_{16}$  to  $C_{18}$  took place. Data suggest that an essential contribution to the protective capacity of amines comes from their surface activity, which is determined in a homologous series by length of the alkyl radical. In contrast to studies in an acid environment, there is no linear correlation between amine protective capacity and their number of carbon atoms according to the Traube rule. Figures 4; references 7: 3 Russian, 4 Western.

[140-12131]

UDC 615.322:615.272.4].03

THERAPEUTIC PROPERTIES OF LYCIUM CHINENSIS MILL

Moscow FARMATSIYA in Russian No 1, Jan-Feb 83 (manuscript received 4 May 82)  
pp 17-19

MURAV'YEV, I. A., VASILENKO, Yu. K., CHYOK, Kh. D., LISEVITSKAYA, L. I.,  
FROLOVA, L. M. and POSTNIKOVA, N. V., Pyatigorsk Pharmaceutical Institute

[Abstract] A study was performed of the composition of the dry extract of a Vietnamese plant, *Lycium Chinensis* Mill. The influence of its steroid saponins and their aglycon on lipid metabolism and the natural resistance of the organism was studied. Leafy branches of the plant, containing 1.5% diosgenin, were used as the raw material. The extract was dried, purified, redried in a vacuum evaporator and drying cabinet, then ground in a ball mill. The steroid glycosides of the plant extract have a clear hypolipidemic effect comparable to the influence of official antiatherosclerotic preparations exceeding that of diosgenin. The steroid glycosides decrease the activity of lysozyme. References 15: 13 Russian, 2 Western.  
[176-6508]

UDC 362.21:615.12

PSYCHIATRIC HOSPITAL PHARMACY EQUIPMENT

Moscow FARMATSIYA in Russian No 1, Jan-Feb 83  
(manuscript received 30 Dec 81) pp 42-44

PANCHENKO, Ye. I., SOLONININA, A. V. and BOBROVA, L. M., All-Union Scientific Research Institute of Pharmacy, Moscow

[Abstract] The table of pharmacy equipment governs the supply of primary technological and supplementary equipment, organizational and technological supply provided for pharmacies at therapeutic-prophylactic institutions. The authors studied the work of psychiatric hospital pharmacies by observation and distribution of questionnaires, establishing the actual presence of equipment, studying documentation related to equipment and instruments. It was found that in contrast to the pharmacies of general hospitals, the prescriptions generated in these pharmacies did not vary widely and cover only a narrow

portion of the pharmaceutical spectrum. Prepared medications, largely psychotropic, predominate in these pharmacies. Isolated storage of these medications is recommended. A proposed table of equipment for psychiatric hospital pharmacies has been developed as a result of these studies. The table is not presented in this article.  
[176-6508]

UDC 661.12.048:547.398.1

#### RECTIFICATION OF TECHNICAL BENZYL CYANIDE

Moscow KHIMIKO-FARMATSEVTICHESKIY ZHURNAL in Russian Vol 17, No 2, Feb 83  
(manuscript received 16 Feb 82) pp 222-225

VINOKUROVA, I. N., STAROSTIN, V. V. and ZELINSKIY, Yu. G., All-Union Scientific Chemical-Pharmaceutical Research Institute imeni S. Ordzhonikidze, Moscow

[Abstract] In order to improve purification of technical benzyl cyanide, the composition of distillation mixture was determined on a laboratory scale. It was established that the following components coexist in the crude being distilled: benzyl ethyl ester (I), benzyl alcohol (II) and the desired benzyl cyanide (III). Phase equilibria for I-II, I-III, and II-III mixtures were determined. Data were processed on a computer system using Wilson equation; the mixture was not ideal, but no binary or ternary azeotropes appeared to complicate the situation. A three component vacuum fractionation unit was designed consisting of two rotating fractionating columns and an evaporator connected in series. This unit provided a 99.76% pure end product with less than 1.5% loss. Figure 1; references 6: 5 Russian, 1 Western.  
[192-7813]

UDC 615.33.012:661.12.013]:628.512.4

#### PURIFICATION OF AIR EXHAUSTS IN PRODUCTION OF ANTIBIOTICS

Moscow KHIMIKO-FARMATSEVTICHESKIY ZHURNAL in Russian Vol 17, No 2, Feb 83  
(manuscript received 26 Aug 82) pp 225-229

BRAVERMAN, G. M., RYBAKOV, S. A., TISHCHENKO, N. F. and EDEL'SON, L. Ya., State Institute of Medical Industry Planning, Moscow

[Abstract] The costs of two purification methods of fermentational and other air exhausts occurring during production of antibiotics was compared: adsorption-oxidation method (I) and thermocatalytic method (II). It was shown that for a 1000 m<sup>3</sup> production volume, both systems were comparable in operational costs for areas where electric energy was inexpensive. With increased cost of electricity, the II system was more economical. In case of a 2000 m<sup>3</sup> capacity, system I was more economical in all cases. Because of the fluctuations in price and volumes, each system should be individually considered

during the design stage to decide the air purification system best suited for its particular situation. Figures 2; references 25: 17 Russian, 8 Western. [192-7813]

UDC 615.35.014.4:007.5

AUTOMATED CONTROL SYSTEM PROPERTIES OF LYOPHILIC DRYING PROCESS FOR BIOLOGICAL PREPARATIONS

Moscow KHIMIKO-FARMATSEVTICHESKIY ZHURNAL in Russian Vol 17, No 2, Feb 83 (manuscript received 15 Jul 81) pp 230-236

SIL'VESTROV, E. M., Scientific Production Association "Vakuummash", Kazan

[Abstract] A common task in all branches of industry concerns automation of technological processes. In the present paper automation of the lyophilization equipment was discussed. One of the most important problems to be solved in this situation is to select a parameter which could control the dynamic equilibrium between the energy removed from the material being dried and the energy supplied from the outside. The existing system based on determination of specific electric resistance was analyzed critically, pointing out its defects. Instead, another system was proposed, based on measurement of the temperature of the material being lyophilized. This approach required programs for individual processes being written, relating specific compounds, temperatures of their lyophilization, etc. Finally, the best parameter representing the stage of a preparation during lyophilization appears to be its moisture generating intensity. When this parameter is used as a controlling factor in automating lyophilization operations, all the problems encountered in other situations were solved; with this approach it was possible to dry just about any type of preparation and to adjust the process to their specific behavioral pattern. Figures 3; references 10: 9 Russian, 1 Western. [192-7813]



UDC 667.644:621.359.3:66.063.6

FORMATION OF DUAL LAYER METALPOLYMER-POLYMER COATS

Kiev UKRAINSKIY KHMICHESKIY ZHURNAL in Russian Vol 49, No 2, Feb 83  
(manuscript received 26 Feb 82) pp 168-173

UL'BERG, Z. R., DEYNEGA, Yu. F., PODOL'SKAYA, V. I., NIZHNIK, Yu. V. and  
DVORNICHENKO, G. L., Institute of Colloid Chemistry and Chemistry of Water  
imeni A. V. Dumanovskiy, UkSSR Academy of Sciences

[Abstract] One of the new trends in electrochemical precipitation is the formation of multilayer composition coats. Formation of the precipitate is the result of homo- and heterocoagulation of particles in areas near the electrodes. The goal of the present study was to examine mechanisms of formation of metalpolymer-polymer coats, to study the electrochemical reactions occurring at the metalpolymer electrodes and their role in forming composition coats. It was shown that by changing the composition of the metal-polymer electrode it is possible to perform the process of electrophoretic precipitation of polymer dispersions at a predetermined polarization, to regulate the concentration of coagulating ions  $\text{OH}^-$  in the layer close to the electrodes and by this to regulate kinetics of the coagulation processes and the properties of coatings obtained. The basic factors affecting the uniform distribution of the material are polarizability of cathode and electroconductivity of the electrolyte. Due to the uniform distribution of the coat and its continuity, these coatings were found to have excellent corrosion and electric resistance. Figures 5; references: 11 Russian.  
[197-7813

UDC 678.5.001.2

PERFECTING ORGANIZATION OF EXPERIMENTAL DESIGN WORK AND PROJECTS IN PLASTICS PROCESSING

Moscow PLASTICHESKIYE MASSY in Russian No 1, Jan 83 pp 3-5

YEVTUSHENKOV, V. P.

[Abstract] This article surveys advances in experimental design and product development work in terms of general organization and information storage and retrieval. Differences between previous metal products and plastic substitutes offer special problems in design and supply, equipment and

manufacturing procedures. Technical and economic implications of new products need to be considered as well. A flow chart from original recognition of need to final full production is offered and explained. An automated information storage and retrieval system has been developed for this industrial branch at the Scientific Production Association "Plastik" in conjunction with the Rostov-on-Don Institute of the National Economy. Standardization of products is another area that offers major benefits both in technical documentation for design development and for economy of production. The need for a centralized information bank at the "Plastik" production association is stressed.

[141-12131]

UDC 678.766.01:539

# PHYSICOMECHANICAL PROPERTIES OF POLYBISMALEINIMIDAMINES OF DIFFERENT CHEMICAL STRUCTURE

Moscow PLASTICHESKIYE MASSY in Russian No 1, Jan 83 pp 9-10

VOLKOV, V. S., LEVSHANOV, V. S., DOLMATOV, S. A., FETISOV, V. S., DUBINA, M. V., and DRYAPOCHKO, Yu. V.

[Abstract] Study of influence of chemical structure and ratios of initial ingredients on physicomechanical properties of title amines began with N,N'-4,4'-diphenylmethanebismaleinimide and N,N'-metaphenylenebismaleinimide, and two forms of aromatic diamines, 4,4'-diaminodiphenylmethane and 4,4'-diaminodiphenylic ester. Samples were tested by pulsed ultra-sound, and spread and suppression of sound waves measured. Oscillations were initiated and measured by electromagnetic means. Calculations using these data indicated that mechanical properties of the title compounds depended on both chemical composition and the molecular proportions of the diamines. With excess BMI (bismaleinimidamines), the polymer formed by reaction of amino-groups with double bonds of the maleinimide rings of the BMI, producing oligobismaleinimidamine that cross-linked by opening the remaining double bonds. While the diamines were quite similar in structure, the two forms of bismaleinimidamines were very different, with the diphenyl variant having greater molecular mass and molecule dimensions. The structure of the diamines had much less impact on the parameters measured than did the structure of the BMI used. References: 3 Russian.

[141-12131]

## EFFECT ON PENTAPLASTIC STRUCTURE OF ANNEALING NEAR MELTING POINT

Moscow PLASTICHESKIYE MASSY in Russian No 1, Jan 83 pp 10-11

ZAVGORODNIY, V. K., KULESHOV, I. V. and MARTYNOV, M. A.

[Abstract] The alpha- and beta-modifications of pentaplast exist in a wide temperature range and contribute to consistent thickness. This article is a study of conversions of pentaplastic structure during annealing at 190-200°C with various cooling regimes. Results showed that the method of producing test samples had a direct influence on the formation of beta- or alpha crystallites and their subsequent conversion into the more stable alpha form, or in the case of some samples, a polymorphic transition of the stable alpha form into the metastable beta-form with significant growth in crystal size. A variant produced at 200°C and cooled to room temperature had high molecular mass, and, during annealing, showed rapid increase of beta-modification with insignificant alpha-modification formation. Low-crystalline samples generally showed secondary crystallization taking place simultaneously in both forms. References 5: 1 Russian, 4 Western.

[141-12131]

## RESULTS OF CURRENT RESEARCH IN PLASTIC WELDING (REVIEW)

Moscow PLASTICHESKIYE MASSY in Russian No 1, Jan 83 pp 26-28

KOMAROV, G. V. and SHESTOPAL, A. N.

[Abstract] The role of welding costs and effectiveness in final assembly of plastic products is discussed in terms of contact zones in polymer-polymer systems, as measured by electron-probe X-ray spectral analysis, for various methods of welding. Chemical bonds are made in incompletely hardened plastics, cross-linked thermoplastics, polymers with ladder macromolecular structure and certain crystallized thermoplastics. Since parameters such as failure tension and durability coefficients do not give a true picture of seam strength, new ones are being relied on: specific energy of failure and elastic resistance to failure. Heated instruments for welding plastics have been found to provide highly durable bonds when surfaces are properly prepared and the lowest effective pressure is applied during heating of units. This type of welding is particularly advantageous where appearance is of great importance. Ultra-sound welding is the second most popular method, and equipment for it is constantly being developed. Frequency is generally 40 kilohertz and 125-300 watt generators are employed. Current new methods include vibrational friction and laser and heated gas technology. References 36: 11 Russian, 25 Western.

[141-12131]

## EFFECT OF PHASE BOUNDARIES ON DURABILITY PROPERTIES OF METAL-POLYMER SYSTEMS

Moscow PLASTICHESKIYE MASSY in Russian No 1, Jan 83 pp 29-30

BRAUN, Ye. V., KRUGLIKOV, S. S. and SIMONOV-YEMEL'YANOV, I. D.

[Abstract] Expanding use of metal-polymer systems in numerous applications calls for improved adhesion durability. The current study focuses on laminated and metal-filled materials, specifically on the state of the metal surface and its impact on bonds with epoxy fiberglass, based on ED-8 epoxy resin hardened with 3,3-dichloro-4,4-diaminodiphenylmethane. Foil application was at 160°C for 15 min with 3 MPa pressure. The effects of surface development was tested using non-polar polyisobutylene (PIB-200). Results indicated that the form of crystals on foil surface did not depend on the type of metal or the alloy (excepting tin); only the density of surface distribution was changed. Adhesion durability of a compound with PIB-200 agreed well with surface development and increased in the order copper→tin→nickel→tin+zinc→copper+zinc(70)→copper+zinc(30)→copper+tin→copper+nickel→tin+nickel→zinc+nickel→zinc. A similar hierarchy of adhesion durability is presented for an epoxy compound, and the hypothesis of donor-acceptor formation determining these values is discussed. Thus adhesion durability is related to both the nature of a metal and its surface development. In actual systems contact area and boundary reactions are the determining factors. Figure 1; references:

7 Russian.

[141-12131]

## ANALYSIS OF HARMFUL SUBSTANCES EMITTED IN PRESSING PHENOPLASTICS

Moscow PLASTICHESKIYE MASSY in Russian No 1, Jan 83 pp 40-42

EL'TERMAN, L. Ye., SMIRNOVA, G. A. and DEYZENROT, E. I.

[Abstract] Studies of volatile harmful substances emitted in processing polymers are termed inadequate and out of date. To correct this, experimental measurements were undertaken at the "Komsomolskaya Pravda" Plastics Plant. Preliminary findings indicated that material composition, mass, thickness and surface area of the item being pressed should be measured. Consequently, two series of experiments were conducted, the first with 8 brands of novolacs and resol phenoplastics, the second using a single brand to make various items. The first showed that the most emissions came from the resols and the least from novolacs V1-090-34. The second series showed that the quantity of phenols emitted depended on the surface area of the plastics in a linear dependency, in a temperature range of 70-250°C. Figure 1.

[141-12131]

## OPTIMIZING FORMULAS FOR COMPLEX GLUE COMPOSITION

Moscow PLASTICHESKIYE MASSY in Russian No 1, Jan 83 pp 46-47

PETROVA, A. P., DOLZHANSKIY, Yu. M. and SMIRNOVA, N. V.

[Abstract] Selecting optimal components of glue containing two epoxy resins of varying structure, an anhydride hardener and two fillers (zinc oxide and aluminum powder), the authors tested adhesion at 20, 200 and 250°C after varying the proportions of the ingredients. Raw data was analyzed by computer, with a regression coefficient approach that was judged undependable and by analysis of remaining sums, which was regarded as accurate. Results showed that increasing the amount of hardener brought reduction of resistance to shift, independent of temperature; changing resin ratios from 40:60 to 80:20 reduced resistance to shift independent of all other factors. Optimal hardening temperature was 200°C, which gave the highest resistance to shift value--24.0 MPa. The required durability at 250°C was reached only with an 80:20 resin ratio with aluminum powder filler and 10.0 MPa. Figures 2.

[141-12131]

UDC 541(64+24):543.544

## STUDY OF MOLECULAR WEIGHT DISTRIBUTION OF BOROSILOXANE POLYMERS BY GEL-PENETRATION CHROMATOGRAPHY

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 25, No 1, Jan 83 (manuscript received 3 Feb 81) pp 3-7

SOKOLOVA, M. A., ZINCHENKO, G. A., KARTASHEVA, G. G., PODDUBNYY, I. Ya. (deceased) and MILESHKEVICH, V. P., All-Union Scientific Research Institute for Synthetic Rubber imeni S. V. Lebedev

[Abstract] Data on molecular weight distribution of title polymers have previously been unavailable. The authors studied laboratory samples by gel-penetration chromatography using varying catalysts, initial polymers and temperature regimes, also varying molecular characteristics in synthesis under laboratory and production conditions. The universal Benoit calibration was used to calculate molecular mass. Borosiloxane polymers were produced from liquid polydimethylsiloxane rubbers and boric acid. The process was very sensitive to changes in catalysts, which included chloroligomers, Fe-siloxane and dimethyldichlorosilane with added iron chloride. The latter and the temperature of synthesis were shown to be determining factors in the molecular weight distribution of the final product. Increasing temperatures brought increased average molecular mass along with a simultaneous decrease in the coefficient of polydispersion. Figures 3, references 6: 2 Russian, 4 Western.

[145-12131]

## COPOLYMERIZATION OF 1-VINYL-1,2,4-TRIAZOLE WITH METHYLMETHACRYLATE AND STYRENE

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 25, No 1, Jan 83  
(manuscript received 22 Jun 81) pp 14-17

TATAROVA, L. A., MOROZOVA, I. S., YERMAKOVA, T. G., LOPYREV, V. A.,  
KEDRINA, N. F. and YENIKOLOPYAN, N. S., Institute of Chemical Physics, USSR  
Academy of Sciences; Institute of Organic Chemistry, Siberian Division, USSR  
Academy of Sciences

[Abstract] Little study of the title triazole had been conducted previously. The authors assessed the effect of the 1,2,4-triazole group at the double bond through PMR spectra in dioxane solution with  $D_2O$ , with hexamethyldisiloxane as the standard. Presence of an extra positive charge on the nitrogen atom allowed the triazolyl radical to provide an inductive effect as an electron-acceptor grouping; with linking it could also behave as an electron donor causing polarization of the vinyl bond. Calculations established a linear correlation between the Hammett constant and chemical shift parameters. It was anticipated that in copolymerization processes the effect of the 1,2,4-triazolyl radical would be similar to that of a halogen atom. Lesser activity was recorded for 1-vinyl-1,2,4-triazole in copolymerization than for MMA or styrene. Other N-vinylazoles showed similar results, which were attributed to polarization of the vinyl bond through action of the 1,2,4-triazole radical. Figures 2; references 16: 6 Russian, 10 Western.  
[145-12131]

## GAS PENETRABILITY OF ORIENTED POLYETHYLENE FILMS

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 25, No 1, Jan 83  
(manuscript received 15 Jul 81) pp 24-29

BUDTOV, V. P., VOROB'YEV, V. P., GANN, L. A. and MYASNIKOV, G. D.,  
Okhta Scientific Production Association "Plastpolimer"

[Abstract] Mass transfer and deformation processes contribute durability and modular properties to crystalline polymers. Since the effects of elongation forces had not been investigated, the authors studied degree and rate of elongation and determined their impact on gas permeability and diffusion coefficient of low pressure polyethylene film, using argon and helium, gases that would not react with the matrix significantly. Results indicated that the time of stretching played an important role in achieving durability: where the duration of external effects was less than the orientation duration of structural elements, they broke down and formed new structural elements with higher density. In a range of moderate elongation, chain stretching occurred where the coefficient of diffusion decreased in proportion to the

increase in deformation. Further tests showed that excessively rapid rates of deformation led to structural failure, as relaxational processes did not take place. Figures 6, references 10: 8 Russian, 2 Western.  
[145-12131]

UDC 541.64:532

#### SELECTIVITY OF GAS PERMEABILITY IN POLYMERS

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 25, No 1, Jan 83  
(manuscript received 15 Jul 81) pp 30-36

VOLKOV, V. V. and DURGAR'YAN, S. G., Institute of Petrochemical Synthesis  
imeni A. V. Topchiyev, USSR Academy of Sciences

[Abstract] Selective permeability, related to temperature and pressure, is determined by a coefficient of solubility and a coefficient of diffusion, but differences in selectivity involves other factors as well. Variations in permeability are discussed for crystalline polymers (polyethylene), porous polymers (polystyrene and triacetyl cellulose) and glass-like polymers (polyvinyltrimethylsilane and poly-2,6-dimethylhydroxyphenylene), the latter having much higher selectivity for He-N<sub>2</sub> vapor. Analysis indicated that the amount of free volume of a polymer involved in transfer of gas molecules depended greatly on the polymer's kinetic rigidity and had a minimum at the transition from highly elastic polymers to glass-like ones. The glass-like polymer would have greater selectivity for gas permeability with equal gas transfer values. Figures 3; references 20: 12 Russian, 8 Western.  
[145-12131]

UDC 541(64+15):537.7

#### RADIATION IMPULSE ELECTRICAL CONDUCTIVITY OF AROMATIC POLYIMIDES DIFFERING IN STRUCTURE OF DIANHYDRIDE COMPONENT

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 25, No 1, Jan 83  
(manuscript received 28 Jul 81) pp 99-106

TYUTNEV, A. P., SAYENKO, V. S., TIKHOMIROV, V. S. and POZHIDAYEV, Ye. D., Scientific Production Association "Plastmassy"; Moscow Institute of Electronic Machinebuilding

[Abstract] Induced electrical conductivity during impulse radiation of polyimides has applications for dielectrics and electrical insulation materials. The present study considered broad possibilities of electrical registration of charged particles during impulse radiation of polymers, and intended to explain the nature of the effects of chemical structure of elemental polymer chains on their induced electrical conductivity. Polyimides were found to take on this feature at much higher radiation dosages than other

polymers. Extreme radiation conditions did not have the expected impact, but an electrical field had a strong impact on the nature of rise and fall of the radiation current in tested polyimides with a particularly strong "super-linearity" for slower relaxational components of the current. While many factors of the synthesized polyimides and polyamidoacid films remain unexplained, structural modifications and linking are apparently tied to thermoradiational modifications that, however, remained incomplete in the tests conducted so far. Figures 7; references 20: 17 Russian, 3 Western. [145-12131]

UDC 541.64:547.538.141

STUDY OF ADDITION OF EPICHLOROHYDRIN TO p-BENZOQUINONE-STYRENE COPOLYMER IN PRESENCE OF AMINE CATALYSTS

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 25, No 1, Jan 83 (manuscript received 30 Jul 81) pp 139-143

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[Abstract] Epoxy oligophenols have valuable properties such as increased heat- and thermal-durability; thus the reaction of the title epichlorohydrin with oligophenols and their copolymers, e.g. the title combination, are of interest. Catalysts tested were triethylamine and its complex with ethyl alcohol and hydroxides of tetraethylammonium. Reaction time was found to vary markedly in dependence on the manner of preparing the catalyst, increasing as initial amounts of the copolymer and catalyst were increased. Experimental results and previous reports indicate that in complex formation of alcohols with tertiary amines, the latter's basicity increases, and the complex produced polarizes like quaternary ammonium bases so that it reacts readily with acid phenol hydroxyls of the copolymer. Figures 4; references 9: 8 Russian, 1 Western. [145-12131]



STUDY OF PATTERNS OF VISCOUS ELASTIC BEHAVIOR OF HEAT-RESISTANT POLYMERS  
(BASED ON EXAMPLE OF POLYOXADIAZOLE AND POLYIMIDE)

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 25, No 1, Jan 83  
(manuscript received 18 Feb 82) pp 203-211

ASKADSKIY, A. A., VIKHAUSKAS, Z. S., BANYAVICHYUS, R. B. and MARMA, A. I.,  
Institute of Heteroorganic Compounds, USSR Academy of Sciences, Kaunas  
Polytechnical Institute imeni Antanas Snehkus

[Abstract] Relaxational properties of the title polymers are studied and comparative analysis of viscous elastic properties of other heat-resistant polymers made. Results showed a clear non-linearity in relaxational processes. As critical tension and its corresponding deformation grew, the working interval of material that had not reached the point of mechanical softening increased. Kinetic features and temperature effects for various polymers indicated that heat-resistant polymers can be divided into those whose tension relaxation in a relatively low range of temperatures is very poorly manifested, and those with much stronger reactions but with parameters of relaxational processes that are stable practically to glass point under extreme conditions. This information can be applied to selecting polymers for specific tasks. Analysis suggests that determination of the transitional temperature should be studied in the linear range, and the temperature dependency drops sharply as the glass point of a given polymer is approached. Figures 10; references: 9 Russian.  
[145-12131]

UDC 677.463.96.021.12+677.463-96.022

PRODUCTION AND USE OF SIBLON FIBER

Moscow KHIMICHESKIYE VOLOKNA in Russian No 1, Jan-Feb 83  
(manuscript received 18 Nov 82) pp 6-9

SERKOV, A. T. and RADISHEVSKIY, M. B.

[Abstract] Siblon is similar in quality to other viscose high-modulus fibers produced by foreign firms. Its strength is 1.6 times that of ordinary viscose fiber, 2 times when wet. The fiber is formed at relatively low speeds, 25-35 m/min, with plasticizing combined with distillation of carbon disulfide, reduction and thermal fixation of the fiber rather than with spinning. The economic effect achieved by the use of siblon depends on the type of fiber replaced. In 1982, replacing 10% thin fiber and 90% medium fiber cotton, the effect achieved was 339.6 rubles per ton of fiber. This figure may increase to over 600 rubles per ton, depending on the type of fiber which siblon replaces. Figure 1; references: 11 Russian.  
[184-6508]

## LONGITUDINAL DEFORMATION OF POLYMER MELT MIXTURES

Moscow KHIMICHESKIYE VOLOKNA in Russian No 1, Jan-Feb 83  
(manuscript received 8 Feb 82) pp 13-15

TSEBRENKO, M. V. and SIZEVICH, T. I.

[Abstract] A discussion is presented of some regularities of longitudinal deformation of polymer melt mixtures on the example of a mixture of polyoxymethylene and copolyamide 20:80% by mass, in which the phenomenon of specific fiber formation is clearly manifested. Under certain conditions the mixture has an elasticity comparable to that of raw rubber. The total degree of deformation of the melt mixture is quite great, as much as 109800, with each polymer manifesting its capacity for maximum deformation characteristic for the polymer and related to its nature. If the polymers do not interact at the phase interface, one of the components of the mixture may fail in longitudinal deformation. This indicates the great difference in deformability of the two components, with copolyamide more than 4 times as great as polyoxymethylene in deformation capacity. The results indicate that at the phase interface there is an interaction so that the deformability of polyoxymethylene is determined by the deformability of the matrix polymer. Figure 1; references: 9 Russian.  
[184-6508]

UDC [677.494:536.495].021.125.3

## SELECTION OF DRAWING POINT FOR OXALON FIBER IN FORMING

Moscow KHIMICHESKIYE VOLOKNA in Russian No 1, Jan-Feb 83  
(manuscript received 12 May 82) pp 15-16

KRUCHININ, N. P., ROMANOV, V. V., KOZHEVNIKOV, Yu. P., GASHINSKAYA, N. A., SEMENOVA, A. S. and KULICHIKHIN, V. G.

[Abstract] Fibers formed of 5.3% poly-p-phenylene-1,3,4-oxadiazol (POD) solutions in 98% sulfuric acid in water-acid settling baths were studied. The forming installation is diagrammed. A series of fiber specimens was formed to determine the point of effective application of local tension. A typical curve showing strength and elongation at rupture of freshly formed oxalon fiber as a function of point of application of drawing tension shows that the area of most effective action is near the point where tension reaches a constant value. Tension applied near the spinneret is not effective, since the connections between structural elements are weak. Figures 3; references: 2 Russian.  
[184-6508]

## WASHING CHEMICAL FIBERS BY IMMERSION

Moscow KHIMICHESKIYE VOLOKNA in Russian No 1, Jan-Feb 83  
(manuscript received 1 Mar 82) pp 21-23

DANILIN, G. A., KALITIN, V. A. and GLAZUNOV, V. B.

[Abstract] Washing is a necessary stage in the production of chemical fibers by the wet method. Experiments and calculations have shown that washing of chemical fibers is based on the general regularities of mass transfer. The defining parameter characterizing the process of washing is the dimensionless concentration of the component in the fiber after washing. The washing of viscose fibers follows the mechanism of molecular diffusion. The process can be intensified by repeated interruption. Formulas are presented for determining the mean concentration of the component after various numbers of washings. Studies were performed on an experimental installation in which the fiber was repeatedly immersed in water. Calculation and experimental measurements were used to determine the values of the parameters of the process. Figures 4; references: 7 Russian.  
[184-6508]

## FILTERING CONCENTRATED SULFURIC ACID

Moscow KHIMICHESKIYE VOLOKNA in Russian No 1, Jan-Feb 83  
(manuscript received 14 May 82) pp 29-30

MATVEYEV, V. S., OPRITS, O. V., VASIL'EV, V. I. and SOKOL, V. S.

[Abstract] Results are described from solving the problem of determining the permissible content of contaminants in sulfuric acid and selecting a technical solution to achieve the necessary degree of purification as applicable to the production of oxalon fiber which is produced from solutions of polyoxydiazol in sulfuric acid. To determine the necessary degree of purification, fiber was formed under the same conditions from the same batch of spinning solution, in individual batches differing only in content of contaminants intentionally introduced to the purified solution. The necessary degree of purification is achieved only by the use of ftorlon or metal ceramic filters with pore size 50  $\mu\text{m}$ . However, the kinetics of plugging of these filters are quite unfavorable. The process of filter regeneration thus becomes more important as process capacity is increased. Settling is considered a promising means of purification of sulfuric acid, with the required clarity reached in 5 to 6 days. Figures 2; references 3: 2 Russian, 1 Western.  
[184-6508]

## GAS SEPARATING HOLLOW POLYVINYLTRIMETHYLSILANE FIBER

Moscow KHIMICHESKIYE VOLOKNA in Russian No 1, Jan-Feb 83  
(manuscript received 28 May 82) pp 40-42

KOSTROV, Yu. A. and NOVIKOVA, T. A.

[Abstract] This article studies the possibility of producing gas separating fibers of PVTMS, as well as the influence of the method of formation and type of solvent and settling agent (in wet formation) on the pore structure and gas separating capacity of the hollow fibers. The fibers were produced from a polymer with a molecular mass of 90,000 and a characteristic viscosity of 2. Transverse cross sections of the fiber were studied by a light microscope with no special contrasting. The permeability of the fiber walls was determined by the volumetric and chromatographic methods. The values of the separation factor for oxygen and nitrogen were similar for all fibers with diffusion permeability, whether completely monolithic or with monolithic layers. The results of the study show that by changing the method of formation and subsequent processing it is possible to regulate the pore structure of hollow PVTMS fiber and the related gas permeability, as well as the mechanical properties of the fiber, over broad ranges. Figures 2; references: 4 Russian.  
[184-6508]

## SPECIFICS OF OXALON FIBER FORMATION

Moscow KHIMICHESKIYE VOLOKNA in Russian No 1, Jan-Feb 83  
(manuscript received 17 Jun 81) pp 42-43

BOBROVNITSKAYA, N. I., ROMANOV, V. V., KALASHNIK, A. T., SOROKIN, V. Ye., SEMENOVA, A. S. and MAKAROVA, R. A.

[Abstract] This article studies the possibility of increasing the molecular orientation in poly-p-phenylene-1,3,4-oxadiazol (POD)-based fibers wet formed in a settling bath of 55%  $H_2SO_4$ . The optimal conditions of working the formed fibers were determined by a device capable of applying mechanical force to the fiber at any distance from the spinneret. The mean molecular orientation of the polymer was determined as a function of position of the device based on the speed of sound, ultrasonic modulus, and the capacity of the fiber for spontaneous elongation at a temperature above the glass point. It was found that the molecular orientation of POD-based fibers could be increased by oriented physical action on the fiber during the formation in the area most favorable for polymer orientation. The nature of change of the orientation factor, elongation modulus of the fiber and its capacity for spontaneous elongation indicate that this method of acting on the fiber is quite effective. Figures 2; references 4: 3 Russian, 1 Western.  
[184-6508]

UDC 541.1+537.525.1

IONO-MOLECULAR REACTIONS IN MIXTURE ( $\text{SF}_6/\text{H}_2\text{O}$ )

Moscow KHIMICHESKAYA FIZIKA in Russian No 1, Jan 83  
(manuscript received 19 May 82) pp 136-138

KARACHEVTSEV, G. V., MAZURIN, I. M., MARUTKIN, A. Z., SAVKIN, V. V. and  
TAL'ROZE, V. L., Moscow Physicotechnical Institute

[Abstract] Impulse mass-spectrometric analysis at increased pressure in an ion source was used to study the title mixture, which is used to suppress electrical charges in various electrotechnical devices. Ion feed was varied to assure a consistent regime of impulse modulation. Intervals between ionizing and retardation impulses were varied from 0 to 150 mcs. Results showed a relatively small ion flow that reached a maximum as reaction time grew. Regrouping in the complexes  $\text{SF}_5^+ \cdot \text{H}_2\text{O}$  and  $\text{SF}_3^+ \cdot \text{H}_2\text{O}$  led to formation of ion products  $\text{SF}_3\text{O}^+$  and  $\text{SFO}^+$ , which although they were exothermal, were prohibited by orbital symmetry since they included temporary formation of four-membered cycles. This probably explains the relatively long life of energy-rich complexes. Figure 1, references 3: 2 Russian, 1 Western.  
[142-12131]

UDC 541.64:547.241

SYNTHESIS AND MECHANISM OF ACTION OF PHOSPHORUS-CONTAINING ACCELERATORS FOR RUBBER VULCANIZATION

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 25, No 1, Jan 83  
(manuscript received 7 Jul 81) pp 18-23

KHAYRULLIN, V. K., ALEKSANDROVA, I. A., SAFINA, N. P., PUDOVNIK, M. A.,  
STRUCHKOV, Yu. T., YUFIT, D. S. and PUDOVNIK, A. N., Institute of Organic and  
Physical Chemistry imeni A. Ye. Arbuzov

[Abstract] To develop accelerators and avoid preliminary vulcanization of scorching, the authors sought universal small additives for resin mixtures that would accomplish these purposes and also serve as antioxidants. They settled on phosphorylated derivatives of dialkyldithiocarbaminic acid containing a four-coordinate phosphorus atom. Details of synthesis are given. The substances prevented prevulcanization and allowed vulcanization at a lower temperature while producing resins that surpassed the standard in physicomechanical features, aging coefficient and Muni viscosity. Study of polyfunctional action of the accelerators showed a higher level of coordination. Structures were confirmed by  $^{31}\text{P}$  NMR spectra. References 6: 2 Russian, 4 Western.  
[145-12131]

UDC 541.64:539.3

EFFECT OF DEFORMATION ON ELASTIC PROPERTIES OF RESINS IN CROSS-LINKING

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 25, No 1, Jan 83  
(manuscript received 21 Aug 81) pp 175-178

PETROVA, S. B. and PRISS, L. S., Scientific Research Institute for Tire Production

[Abstract] Elastic properties of resins are determined by their total "history" of heat and mechanical influences prior to testing. While some aspects of these influences have been studied, little information is available on factors such as ash-gel analysis, vulcanizate elasticity constants and their dynamic properties. The authors sought to fill in these gaps in

knowledge by studying balanced elastic and other mechanical properties of SKMS-30 ARK rubber vulcanizates cross-linked at various degrees of elongation. Calculations of cross-linking in a stretched state followed by chain relaxation were found to be only approximate, since the "front factor" for a single direction could not be calculated, and the general problem for an anisotropic grid should have been considered. The anisotropic effect of elastic properties during vulcanization under stretch can only be explained on the basis of a hyperelasticity theory that includes steric reactions between chains of the grid. Changes in the circumstances in which the grid are formed can have an essential effect on mechanical properties of vulcanizates, especially on their balanced elastic properties and the loss module. Figures 2; references 9: 2 Russian, 7 Western.  
[145-12131]

UDC 678.065.004.67

#### BASIC TASKS IN DEVELOPMENT OF TIRE RETREADING AND REPROCESSING OF WORN-OUT TIRES DURING ELEVENTH FIVE-YEAR PLAN

Moscow KAUCHUK I REZINA in Russian No 1, Jan 83  
(manuscript received 17 May 82) pp 2-4

SKOKSHIN, L. V., KRIVUNCHENKO, L. N. and KAMENSKIY, B. Z., All-Union Production Association "Soyuzremshina", Scientific Research Institute for Tire Production

[Abstract] The call of the 26th Party Congress for conservation of raw materials and other material resources has led to new efforts in the tire fields in order to conserve rubber, synthetic fibers, technical carbon and steel. Retreading and reclaiming rubber from worn-out tires can save on expenditures for imported, expensive rubber. The number of retreads for 1981 exceeded those for 1975 by 25%, and further increases are included in the 11th Five-Year Plan. New plants and renovation and automation of old plants will contribute to the total, which will include a broader assortment of tires for automobiles and trucks. Direction for technical improvements include elimination of existing disproportions between energy supply and production capacity of collection and preparation facilities and vulcanization plants, and general modernization. Technical problems include processes for crushing and processing tires with steel cord breakers, thermomechanical processing of reclaimed rubber based on butyl rubber, and radiation processing to obtain high quality substitutes for rubber. Quality and cost control objectives are also stressed, and needs for management improvements to assure a steady supply of recycling materials are noted.  
[146-12131]

## SYNTHESIS OF POLYDIMETHYLSILOXANE RUBBERS BY CONDENSATION OF SKTNV AND CYCLOSILOXANES

Moscow KAUCHUK I REZINA in Russian No 1, Jan 83 (manuscript received 5 May 80)  
pp 5-8

SEVAST'YANOVA, I. V., PONOMAREV, A. I. and KLEBANSKIY, A. L., All-Union Scientific Research Institute for Synthetic Rubber imeni Academician S. V. Lebedev

[Abstract] Presently siloxane elastomers are made by polymerization of cyclosiloxanes involving acid or alkaline catalysts. Since catalyst residue causes polymer chain failure at high temperatures, the authors sought a method to avoid their use. Synthesis of polydimethylsiloxane by condensation of cyclosiloxanes with low-molecular polydimethylsiloxane- $\alpha$ ,  $\omega$ -dioles was found to take place in a broad temperature range, with best results at 175°C. At low temperatures the reaction was too slow, while at higher temperature the product's molecular mass was insufficient due to elimination of the silazane component. With higher molecular weight of the original SKTNV, the process was shortened. Since the final product could contain unreacted silazane bonds, the authors studied their effect on the vulcanate's properties, and determined that the presence of residual nitrogen reduced physicomechanical parameters in both aged and unaged products. Apparently the residual silazane groups reacted with free hydroxyl groups of aerosyl in a supplementary vulcanization. The nature of the initial dioles had a major impact on the resulting resins. The best results came when a diol obtained from chloro-oligomers was used. While the rubber produced by this method was initially somewhat lower in parameters than production-line rubbers, after thermal aging it surpassed them, for losses in durability and relative stretch were significantly less than those for production rubbers. Figure 1; references 9: 8 Russian, 1 Western.  
[146-12131]

UDC 678.7-019.3:541.24

## FEATURES OF MOLECULAR MASS DISTRIBUTION CHANGES OF BUTYL RUBBER IN PROCESS OF DESTRUCTION OF ITS SOLUTIONS

Moscow KAUCHUK I REZINA in Russian No 1, Jan 83  
(manuscript received 26 Mar 82) pp 8-10

VOL'FSON, S. I., KARP. M. G., ZARIPOV, I. N. and YEKIMOVA, A. M., Kazan Chemicotechnological Institute imeni S. M. Kirov

[Abstract] The title process is used to obtain oligomers with useful properties. The authors sought to obtain information on patterns of molecular weight distribution (MWD) during this destruction under the effect of ozone and in the presence of aluminum chloride. Results showed that as destruction



increased, polydispersion first grew until it achieved a clear maximum point, after which it declined. The nature of MWD changes was the same for both types of destruction, and molecular characteristics dependent on the number of breaks per molecule were not tied to solution concentration or intensity of destruction in the studied range. Branched structures of MWD expansion and isoprene links in ozonolysis are discussed. Apparently changes in butyl rubber MWD are related to breakdown in peripheral layers, since central layers are protected by the heterogeneity of the catalytic destruction process. Figures 2; references 17: 11 Russian, 6 Western.  
[146-12131]

UDC 678.4.002:678.675.001

EFFECT OF DICARBOXYLIC ACIDS AND THEIR DIHYDRAZIDES ON PROPERTIES OF  
VULCANIZATION OF ETHYLENE-PROPYLENE RUBBER

Moscow KAUCHUK I REZINA in Russian No 1, Jan 83 (manuscript received 3 Jul 81)  
pp 24-26

DERBISHER, V. Ye., KABLOV, V. F., KOROTEYEVA, A. M. and OGREL', A. M.,  
Volgograd Polytechnical Institute

[Abstract] The title vulcanizates have high resistance to aggressive and aqueous media, good dielectric properties and technical qualities, but radiation and peroxide vulcanization do not produce products that can be used above 150°C. The authors sought to modify them with such additives as polycondensational monomers, including the title acids, diesters, acid dihalides and anhydrides that also react with dihydrazides at high temperatures to produce polyhydrazides. Results showed that polycondensation occurred only at high temperatures at the vulcanization stage. With growth of the methylene chain the elasticity and durability of the resins increased while their hardness decreased. Their resistance to thermal oxidation also increased. Introduction of only one monomer brought reduced durability. Heat effects bore witness to simultaneous vulcanization, polycondensation and perhaps polycyclization as well. In general there seem to be good prospects for using organic dicarboxylic acids and their dihydrazides in ethylene-propylene synthetic rubbers to increase resistance to thermal and thermo-oxidational aging. Figure 1; references: 12 Russian.  
[146-12131]

## WATER TREATMENT

UDC 628.345

### PREDICTING OPERATION OF SETTLING INSTALLATION WITH PRELIMINARY FLOCCULATION OF SUSPENDED MATTER

Moscow VODOSNABZHENIYE I SANITARNAYA TEKHNIKA in Russian No 1, Jan 83 pp 7-9

EPSHTEYN, S. I., MUZYKINA, Z. S., candidates of technical sciences and ZASLAVSKIY, V. M., engineer, All-Union Scientific Research and Planning Institute for Ferrous Metallurgical Energy and Purification, Kharkov

[Abstract] The authors' institute developed and employed flocculation chambers for the title purpose involving gradient coagulation, with the 3 stages of hydraulic study of a given installation model to determine hydraulic values, study of flocculation processes at the planned speed of normal operation determining floc distribution and calculation of floc precipitation parameters. The first stage determines the volume and diffusion coefficient relative to full operation and the degree of flow disturbance in the installation, while the second defines distribution of flocs during the coagulation process. The predicting procedure has been employed at the "Azovstal" (Azov Steel) plant to measure efficiency of gas removal from sewage. The predicted date and actual plant experience with the oxygen-conversion operation at the plant show the value of this procedure. Figures 4; references: 3 Russian.  
[149-12131]

UDC 628.163

### BACTERIOLOGICAL ASPECTS OF PURIFYING SEWAGE IN BIOLOGICAL PONDS

Moscow VODOSNABZHENIYE I SANITARNAYA TEKHNIKA in Russian No 1, Jan 83 pp 9-10

YATULENE, N. M., candidate of medical sciences, Scientific Research Institute for Microbiology and Hygiene, Vilnius

[Abstract] The author surveys bacteriological contamination of water purification ponds of small cities, which are characterized by high levels of coliform, Salmonella and other pathogenic enterobacteria. Purification prior to use as irrigation water or release into open bodies of water has involved biological contact ponds containing microflora. During the months when photosynthesis is active in Lithuania (April-November), this method is effective in reducing coliform bacilli by 72.4-91.9% daily. Observations over several years showed

that the results of a single day in spring and summer took 5 days to accomplish under reduced photosynthetic conditions in the fall, as temperature and hours of daylight decreased. Data indicate a sharp decline in coliform bacilli in the 3rd-5th days after introduction of microflora. During winter the self-purification process was found to continue at a slower rate. In the Baltic republics 8-10 day exposure in biological contact ponds was found to provide acceptable purification. Figures 2.  
[149-12131]

UDC 628.12:628.32:65.014.011.56

#### AUTOMATION OF WATER CHLORINATION AT TALLINN WATER PLANT

Moscow VODOSNABZHENIYE I SANITARNAYA TEKHNIKA in Russian No 1, Jan 83 pp 21-22

SUTT, I. I., engineer, Tallinn Water Plant and MIKHAYLOVA, G. V., candidate of technical sciences, Moscow Scientific Research, Planning and Survey Institute for Water Supply and Sewers of Moscow

[Abstract] Chlorine is used in central water systems both for the water supply and to purify sewage, but very few chlorination operations are automated, due to a lack of mass-produced equipment. The workers at the Tallinn Water Plant developed such a system and have been using it for some years. The key component of the system is the dispenser of chlorine, which was designed by the Tallinn "Kommunalproyekt" design institute in two versions. Its operation is described. It can supply 2, 4, 6, 12, 20, 40, 60, 80, or 100 kg/hour, and will operate for more than one year without maintenance halts. The control system provides automatic regulation of chlorine input based on water consumption for primary chlorination, while for secondary chlorination, a manual analysis of chlorine absorption of the water is required. The dispenser has been installed at Kishinev and Narva, and further applications are being installed at Kalinin. Figures 2.  
[149-12131]

## MISCELLANEOUS

UDC: 621.593.001.24

### SEPARATION OF MULTICOMPONENT GAS MIXTURES IN MEMBRANE ELEMENTS

Moscow TEORETICHESKIYE OSNOVY KHIMICHESKOY TEKHNologii in Russian Vol 17,  
No 1, Jan-Feb 83 (manuscript received 1 Dec 80) pp 60-65

BORISEVICH, V. D., KOZHEVNIKOV, V. Yu., LAGUNTSOV, N. I. and  
SULABERIDZE, G. A.

[Abstract] Methods are developed for designing membrane elements for the separation of multicomponent mixtures. The process of separation in a membrane element depends essentially on the type of flow of the gas mixture in the high and low pressure cavities. A simple element is studied in which a single flow enters and two flows exit, that which penetrates the membrane and that which does not. Calculation of the operation of an element is reduced to solution of a system of differential equations with boundary conditions. When multicomponent mixtures are separated in membrane elements there are a number of specifics which must be considered in designing both single and multistage gas separators. The distribution of concentrations in the exit flows and the productivity of the element depend on the composition of the initial gas and the relationship between the gas permeability coefficients. The method of calculating the separation characteristics of a membrane element can be extended to other type of gas flow in high and low pressure cavities. Figures 4; references 7: 6 Russian, 1 Western.  
[168-6508]

UDC 621.593.001.24

### DESIGN OF MEMBRANE GAS SEPARATING APPARATUS WITH SERIES CONNECTION OF MEMBRANE ELEMENTS

Moscow TEORETICHESKIYE OSNOVY KHIMICHESKOY TEKHNologii in Russian Vol 17  
No 1, Jan-Feb 83 (manuscript received 8 Jan 81) pp 109-110

CHEKALOV, L. N., TALAKIN, O. G., NARINSKIY, A. G. and BABENKOV, A. A.,  
Scientific-Production Association of Cryogenic Machine Building

[Abstract] A method is developed for designing gas separation apparatus with successive connection of membrane elements. Such apparatus is usually used to enrich air with nitrogen. It is distinguished by a high value of the ratio of

gas fed into each element to gas which penetrates through the element. Several membrane devices were studied differing in the number of sections connected in series. The flow rates of apenetrates and penetrates, rarefaction in space beneath membrane, pressure drop and oxygen concentration were measured. The gas was analyzed chromatographically. The results produced indicated that the effectiveness of the apparatus increases with increasing number of elements. A cell model can be used to calculate the operation of apparatus with relatively small membrane sizes. Figures 3; references: 6 Russian.  
[168-6508]

CSO: 1841

- END -